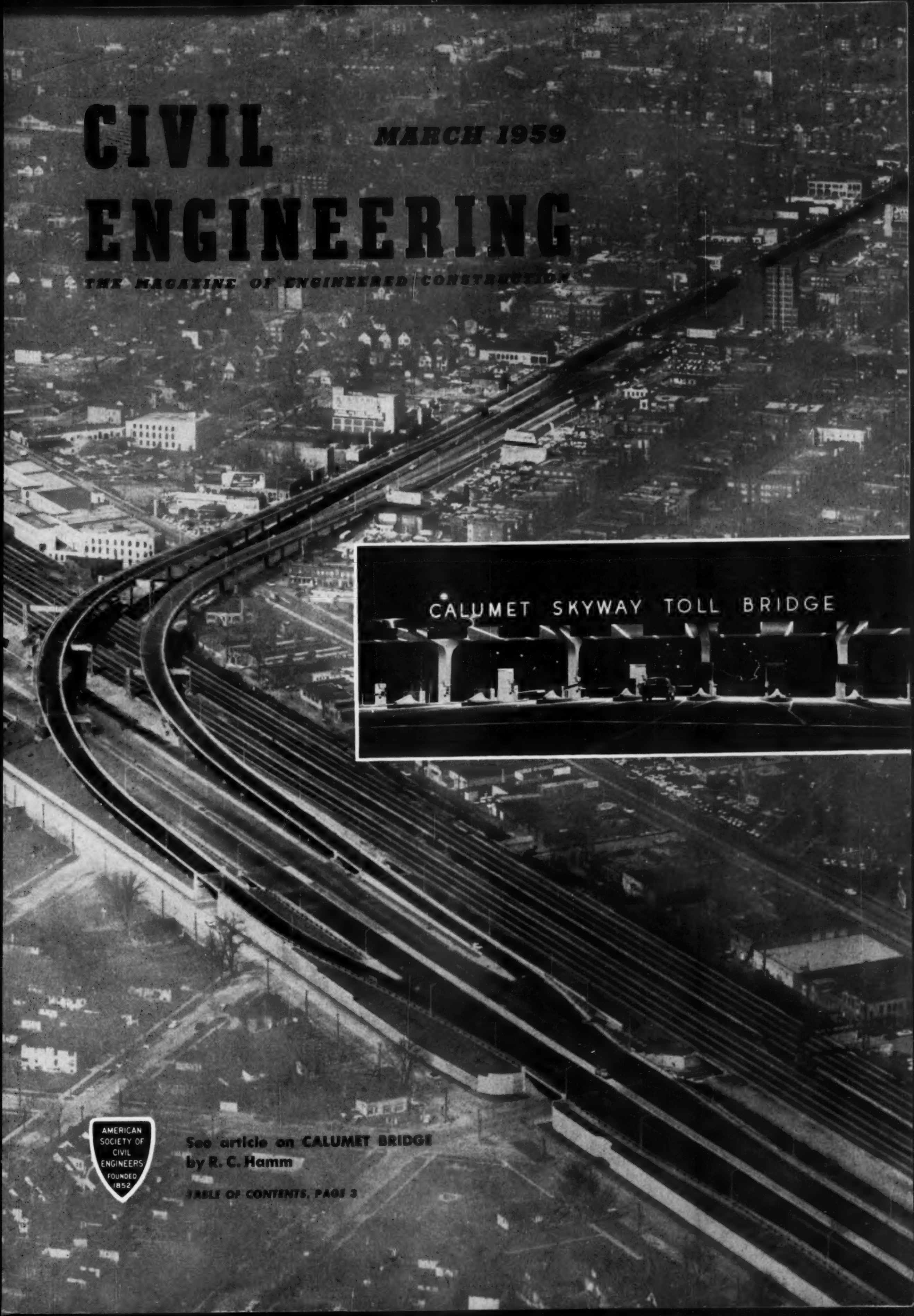
CIVIL ENGINEERING

MARCH 1959

THE MAGAZINE OF ENGINEERED CONSTRUCTION



AMERICAN SOCIETY OF CIVIL ENGINEERS FOUNDED 1852

See article on CALUMET BRIDGE by R. C. Hamm

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Civil Engineering, March 1959, Vol. 29, No. 3 • Published monthly by the American Society of Civil Engineers. Publication office Concord, New Hampshire. (Second-class mail privileges authorized at Concord, New Hampshire.)

Subscription Rates—Price 50 cents a copy. $5.00 a year in advance; $4.00 a year to members and to libraries; and $2.50 a year to members of Student Chapters. Canadian postage 75 cents, and postage to all other countries outside of the United States and possessions, $1.50 additional.

Member Audit Bureau of Circulation

49,500 copies of this issue printed

CIVIL ENGINEERING

MARCH 1959
VOL. 29 • NO. 3

THE MAGAZINE OF ENGINEERED CONSTRUCTION

• ARTICLES

• SOCIETY NEWS

• NEWS BRIEFS

• DEPARTMENTS

AMERICAN SOCIETY OF CIVIL ENGINEERS FOUNDED 1852

9:15 Shooting Cationic Bitumuls

9:20 Cover-stone is spread

9:25 Tandem rolling of cover-stone

"Flusher" test proves...

CATIONIC BITUMULS

IS YOUR BEST INSURANCE AGAINST SUDDEN SHOWERS

9:30 Flushing the finished Surface Treatment

Recently, we announced the availability of a new product:

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We talked of adaptability to "difficult" aggregate; rapid set; resistance to early rains.

Since then, we have put this new material to many rigorous tests on actual jobs all over the country. We needed rain to show, dramatically, how Cationic Bitumuls protected new paving and surfacing against sudden showers. When we couldn't **get** rain we **made it!**

CONSTRUCTION DATA:

On a very revealing test in Long Beach, California, for instance, we used a street-flusher to simulate heavy rain. On 1,100 ft. of 72-ft. wide street pavement, various sections were blocked out to provide "control" testing. These sections were "shot" with both regular grades and Cationic Bitumuls; were covered and rolled in rapid sequence. **Within 15 minutes after application of the binder,** the street flusher (as shown above) "watered" these sections with the equivalent of a heavy rain. The sections were then opened to traffic.

RESULTS:

The sections sealed with Cationic Bitumuls retained practically all cover-stone. As expected, the regular grade of emulsified asphalt "washed-out" under this severe test and most of the stone was lost under early traffic.

Many years of research, testing and development work have gone into the production of Cationic Bitumuls. This product offers two distinct advantages to the road building and pavement maintenance industries: it coats almost **all** aggregates, even those usually regarded as "difficult"; and it extends the normal working season.

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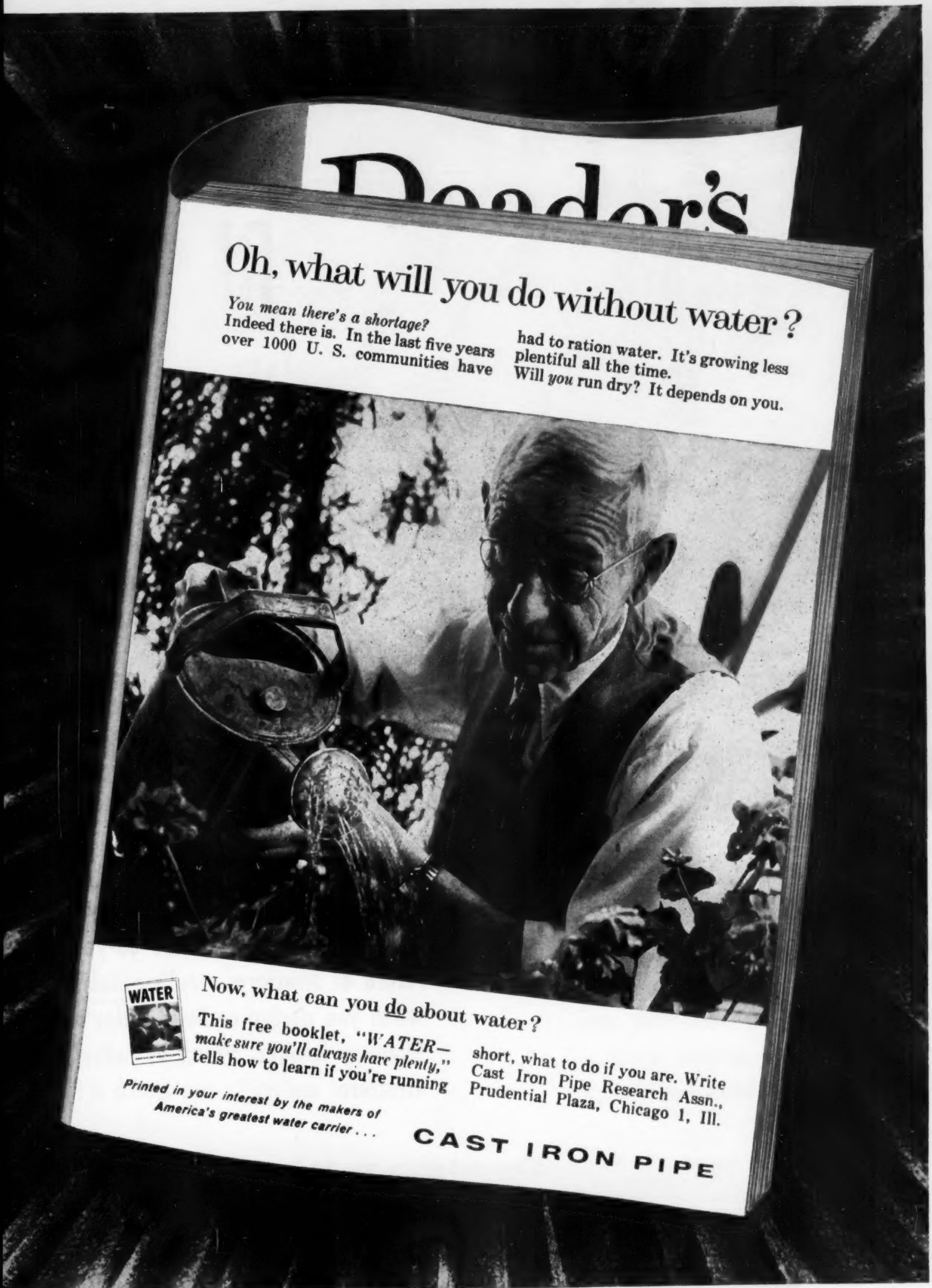
Here's why: the strong TURQUOISE needle-point stays sharp longer. You get the world's cleanest lines—for the world's sharpest reproduction. TURQUOISE'S "electronic" graphite glides more smoothly (without skipping) over every material. And these superior qualities are combined with perfectly uniform grading—pencil after pencil!

So why switch pencils when you switch drafting surfaces? Standardize on Eagle TURQUOISE!

EAGLE®

WANT A FREE SAMPLE? Write for a TURQUOISE lead, pencil, or pencil-with-eraser in the degree you'd like to test on your favorite drafting material. Eagle Pencil Company, Danbury, Conn.


Oh, what will you do without water?
You mean there's a shortage?
Indeed there is. In the last five years over 1000 U. S. communities have had to ration water. It's growing less plentiful all the time.
Will you run dry? It depends on you.
WATER
Now, what can you do about water?
This free booklet, "WATER—make sure you'll always have plenty," tells how to learn if you're running short, what to do if you are. Write Cast Iron Pipe Research Assn., Prudential Plaza, Chicago 1, Ill.
Printed in your interest by the makers of America's greatest water carrier . . .
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CB&I Structure complements beauty and efficiency of new facilities

Engineers for the Port of New York Authority wanted both beauty and utility when they specified this 5,000-barrel Hortonspheroid® for the storage of fuel to serve New York International Airport's new central heating plant. High temperature water, generated in the attractive plant, heats all airport central terminal buildings to eliminate duplication of equipment, service and save valuable space. A second pipe system carries chilled water year-round.

Hortonspheroids are the natural way to store volatile liquids safely and stop evaporation losses. They have also been used for the storage of water. Their beauty, utility and high performance standards are another example of how CB&I's complete design, fabricating and erection facilities are helping modern engineers save time and effort.

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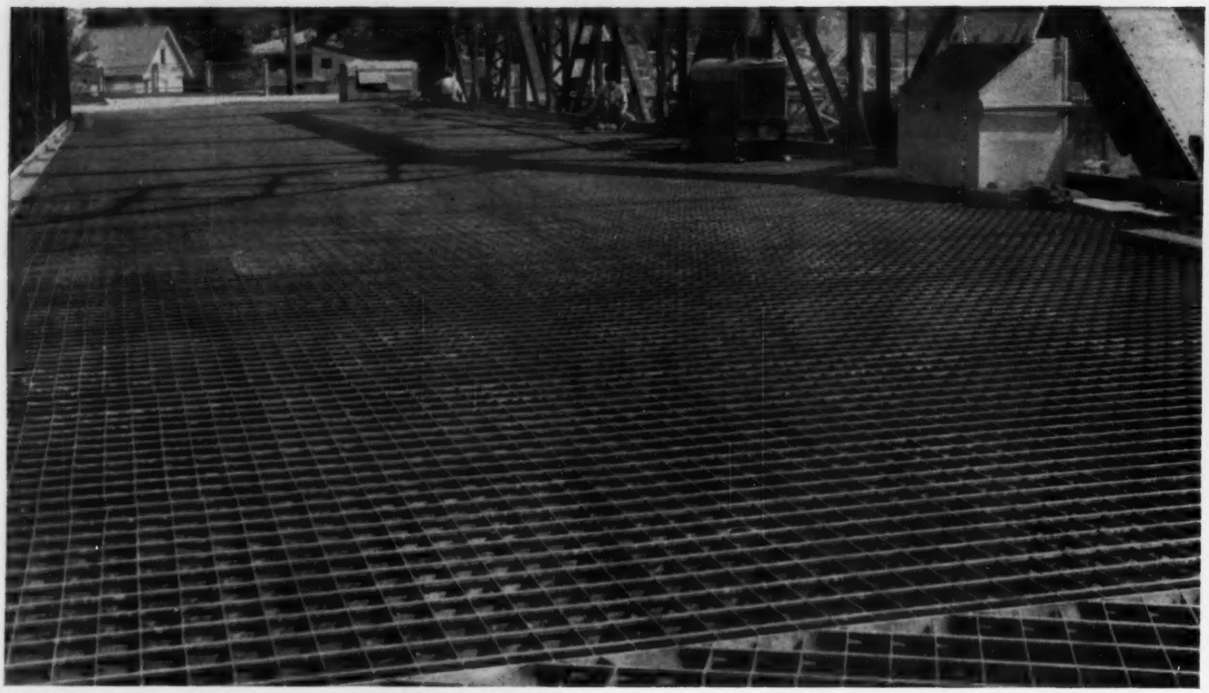

Superintendents on
of reflooring

Carbondale, Pa. Bridge. High Welding Company, contractor. William P. Ross, job superintendent. This bridge has three approaches of various lengths and grades, and one 125′ main span. 4,900 sq. ft. of 4¼″ I-Beam-Lok (with ¾″ overfill) was laid on the main span, with 18,725 sq. ft. of 5″ open-type I-Beam-Lok placed on the three approach spans. Also, 1,000 sq. ft. of Tee-Type Sidewalk Flooring.

The old flooring on the 24′ roadway was made up of a layer of asphalt on 4″ brick, over a series of concrete arches between stringers varying in depth from 6″ at top of arch to 21″ at the stringer. While no accurate weight estimate was made of the complicated floor system, Mr. Ross figured that at most, the new open I-Beam-Lok steel floor weighed but 15% of the obsolete floor it replaced. *In other words, I-Beam-Lok reduced deadweight of approaches approximately 85%.*

In discussing this project, superintendent Ross said that in addition to the usual I-Beam-Lok advantages to contractors (speed of installation, ease of handling, and made-to-order working platform), the use of this lightweight steel flooring eliminated the necessity of working from below the bridge where both railroad tracks and power lines would have been encountered. Conventional construction would have required *two time-and-labor consuming operations—the placing of forms and then stripping them after pouring—* while I-Beam-Lok allowed all work to be performed top-side.

When you want information about a product, go out and talk to the men on an actual job. They deal with facts, not theory. They'll tell you exactly how it handles; whether it does what it is supposed to do; whether it solves problems, or causes them. That's why we visited the two reflooring jobs shown here. Both project superintendents are experts on reflooring old bridges. Incidentally, the men are brothers, and have been employed by the same contractor, High Welding Company, of Lancaster, Pa. for more than 20 years.

USS and I-Beam-Lok are registered trademarks

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CATERPILLAR'S PROJECT PAYDIRT

PAYS OFF FOR YOU AGAIN

Big new Cat No. 14

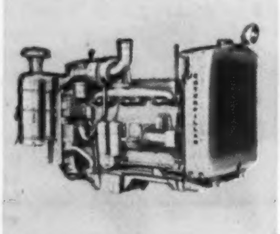
MOST VERSATILE BIG GRADER EVER DEVELOPED

IN THE new No. 14 Series B, Caterpillar brings you the first big grader that delivers high capacity both on the roughest and finest grading work. Another major achievement in Caterpillar's "Project Paydirt," it answers your need for a big unit that comes through dependably with higher, faster, lower-cost production on both control and power applications.

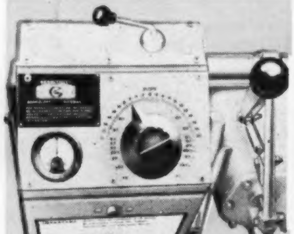
The first and only Turbocharged motor grader, the 150 HP No. 14 operates at the highest practical working speeds with either a 12-ft. or 14-ft. moldboard. It is built with extra strength to match its power and weight. It incorporates the latest engineering advances developed by Caterpillar research.

Example: New design permits increased clearance between moldboard and circle for greater loads. You'll also find exclusive time-tested Caterpillar developments. Example: The oil clutch. Some of these features are listed here, but there are many more. They all pay off in this one fact: You can use the No. 14 profitably anywhere.

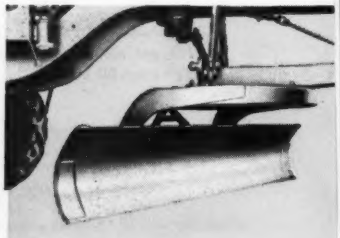
NEW DRY-TYPE AIR CLEANER: Removes 99.8% of all dirt from intake air during every service hour. Can be serviced in 5 minutes.



TURBOCHARGED CAT ENGINE: First and only Turbocharged engine in a grader. Engine provides high 18% torque rise for superior performance.



PRECO AUTOMATIC BLADE CONTROL: Another Caterpillar exclusive, optional on the No. 14. Maintains blade slope within 1/8 in. in 10 ft.



HIGH THROAT CLEARANCE: New design permits increased clearance between moldboard and circle for unexcelled rolling action.

Turbocharged Motor Grader

... WITH HIGH CAPACITY FOR EVERY APPLICATION!

As a result, you don't have to pick "spots" to make the No. 14 a sound investment. This modern, all-purpose big grader will earn its keep on every application with high capacity and low operating cost. But see for yourself. Get the complete facts from your Caterpillar Dealer. Just say when and where—he'll demonstrate.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

✱***PROJECT PAYDIRT:*** Caterpillar's multi-million-dollar research and development program—to meet the continuing challenge of the greatest construction era in history with the highest production earthmoving machines ever developed.

EXCLUSIVE OIL CLUTCH: Provides up to 2,000 hours' service without adjustment, equal to about 12 months' "adjustment-free" operation.

POWER STEERING AND POWER BRAKES: Provide fast, positive response and ease of operation that help operator maintain high production anywhere.

TUBELESS TIRES—14.00-24 (10-PLY RATING): All tires mounted on wide 10-in. rims to stiffen tire side-walls and reduce tire "roll." Large tires on front end improve machine stability.

EXTRA STRENGTH FRAME: Heavy frame, drawbar and circle are ruggedly built to match engine power.

UNEQUALED VISIBILITY: An operator, while seated, has an unobstructed view of critical areas at the front wheels, blade toe and circle.

NEW TURBOCHARGED NO. 14

Engine HP (rated at sea level)	150
Weight	29,280 lb.
Blade—standard	12 ft.
Optional	14 ft.
Tires—all around	14.00-24
Travel speeds—6 forward, 2 reverse	2.6 to 21.6 MPH
Turning radius	36 ft.

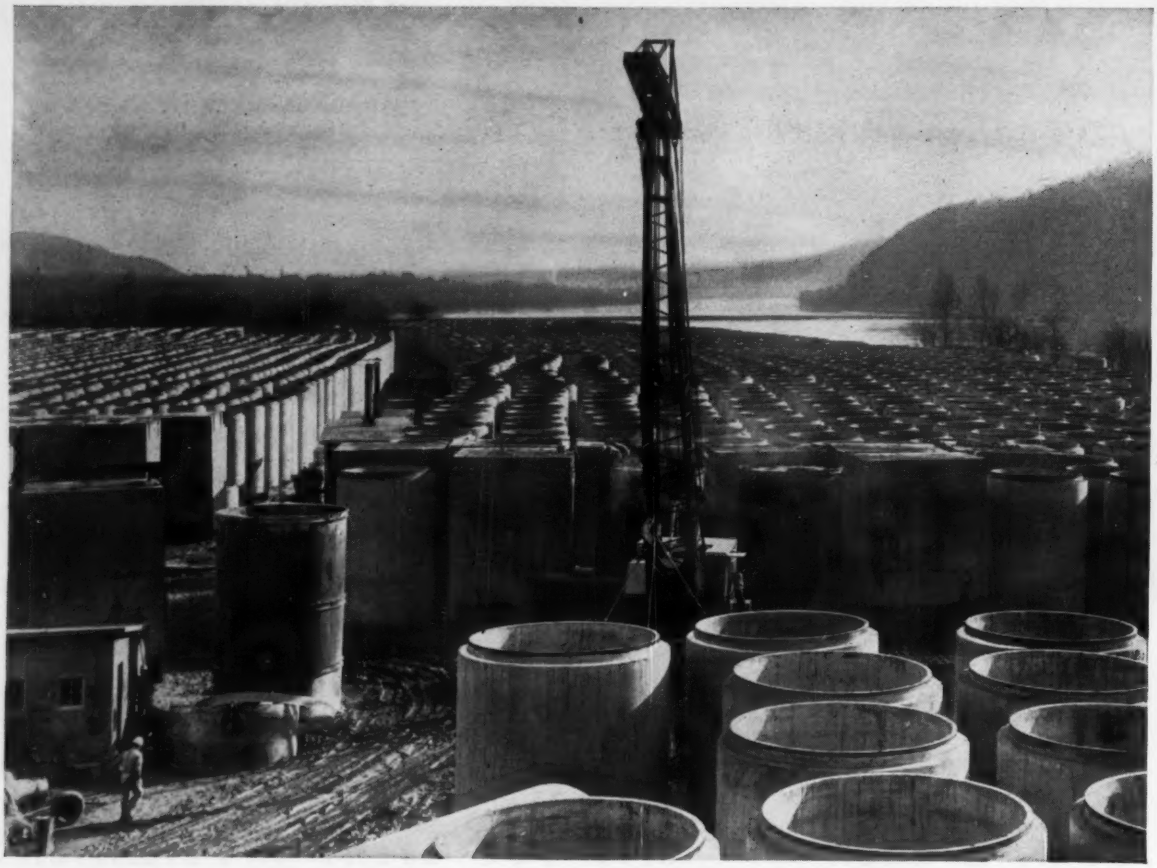
A COMPLETE MOTOR GRADER LINE!

With the addition of the No. 14, Caterpillar now offers a modern, heavy-duty motor grader for every purpose. Other units include the world-famous 115 HP, 23,000 lb. No. 12 and the 75 HP, 20,805 lb. No. 112. Like the No. 14, each is designed to do more work at lower cost with less down time than any unit in its class.

CATERPILLAR

DIESEL ENGINES · TRACTORS · MOTOR GRADERS
EARTHMOVING EQUIPMENT

BORN OF RESEARCH
PROVED IN THE FIELD



Some of the 69 miles of 24- to 126-inch reinforced concrete pipe needed for the Pittsburgh sewer project

Pittsburgh chooses concrete pipe for sewer system designed to last 100 years!

The 70 communities of the Allegheny County Sanitary Authority have planned 100 years ahead for their new intercepting sewer system. This big project involves 69 miles of sewers—30 miles in tunnels and the rest open trench construction.

Needed strength, durability and watertightness are assured by concrete pipe. Extensive testing proved these qualities. Total infiltration into the first 31 miles completed was less than 3 gallons per minute. In many contract sections infiltration was found to be zero.

Other communities everywhere are also finding that concrete pipe can be designed precisely to solve their sewer problems. And concrete pipe are readily available. For the giant Pittsburgh project, special casting yards—including all test equipment—were set up at convenient close-in locations to speed up schedules, keep costs low.

For helpful information on modern concrete pipelines of all kinds, write for free literature. Distributed only in the United States and Canada.

For the Allegheny County Sanitary Authority: John F. Laboon, Executive Director and Chief Engineer; Lawrence M. Gentleman. Deputy Chief Engineer; Richard J. Dougherty, Construction Engineer.

PORTLAND CEMENT ASSOCIATION

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A national organization to improve and extend the uses of concrete

FOR ALL MODERN PIPELINES

concrete


RAYMOND
87%

NEWS OF ENGINEERS

Walter G. Johnson, since 1955 chief engineer of the Kansas State Highway Commission, Topeka, was presented the second annual Highway Award of the Kansas Construction Magazine at the Kansas Contractors Association's January Convention, as the "man judged to have done the most to advance the cause of better highways in the state of Kansas." Mr. Johnson has served in virtually every division of the Commission and gained first-hand knowledge of Kansas highways over a thirty-year period.

W. G. Johnson

Charles T. Wanzer, vice president and manager of construction of the Duke Power Company, Charlotte, N. C., has been named chief engineer of the company. Mr. Wanzer joined the Duke interests in 1918, and has played a key part in building generating facilities.

William C. Teas has been admitted into the partnership of Teas and Steinbrenner, engineers of Hauppauge and Malverne, N. Y.

Robert L. Boehmig, until recently engineer with Morris, Boehmig and Tindel, Inc., of Atlanta, Ga., announces the opening of his office for the practice of structural engineering. The office is in the Bona Allen Building, Atlanta.

Charles C. Whittelsey, president of Ford, Bacon & Davis, Inc., engineers and business consultants with offices in New York, Chicago, and Los Angeles, was recently elected chairman of the board. A member of the firm since 1925, he will continue as president and chief executive officer. Mr. Whittelsey has been in charge of engineering and construction on many of the firm's contracts for large scale projects, including the construction of some of the AEC's structures at Oak Ridge, Tenn.

C. C. Whittelsey

Gordon K. Ebersole, assistant chief, Branch of Training and Conferences, Office of Foreign Activities, U. S. Bureau of Reclamation, Washington, D. C., has left for Korea, where he will serve with the International Cooperation Administration in its participants' training program. Mr. Ebersole will have responsibility for the coordination of the program through which Korean nationals receive engineering and other technical training in the United States and third countries.

G. K. Ebersole

Glen Harold Abplanalp and **Alvin M. Mock,** principal engineers, with Havens and Emerson, consulting engineers of New York, N. Y. and Cleveland, Ohio, have been admitted into the firm as partners. New associates of the firm include **George D. Simpson, Carl E. Lesher, Jr.,** and **Sol Koplowitz.**

(Continued on page 24)

News of Engineers

(Continued from page 22)

H. R. Hallock has resigned as executive vice president of the Texas Atomic Energy Research Foundation and director of research for the Texas Electric Service Company, Fort Worth, Tex., to join Gannett Fleming Corddry & Carpenter, Inc., of Harrisburg, Pa., as director of the General Engineering Division. Colonel Hallock, a graduate of West Point, and a member of the U. S. Army Corps of Engineers, retired from the Army in 1957 after twenty years of service.

H. R. Hallock

H. Banks Kinnison, chief for the Western States of the U. S. Geological Survey's Surface Water Branch, retired recently after more than forty years service with the Federal Government. Prior to becoming chief for the Western States, with offices in Menlo Park, Calif., he served for thirty years as district engineer in Boston, Mass.

Robert L. Blandford has been transferred from the Chicago, Ill. general sales office of the Chicago Bridge & Iron Company to the Tulsa, Okla. sales office. Before joining Chicago Bridge, Mr. Blanchford was employed as an engineer with the city water department of Hammond, Ind. **James T. Dunn,** a member of the Chicago office for several years, has moved to the Philadelphia sales office.

James L. Sherard, a partner in Woodward, Clyde, Sherard and Associates, will head the firm's new office with headquarters at Canada House in New York. Mr. Sherard was formerly in charge of the Denver, Colo., office. The firm's work is in the field of soil mechanics and foundation engineering.

William P. Hughes, since 1952 urban engineer for the Idaho State Highway Department at Boise, has retired after more than fifty years of state and other public service. Mr. Hughes, for many years city engineer at Lewiston, Idaho, is responsible for the completion of a $1,500,000 municipal airport at Lewiston. He is past-president of the Society's Spokane Section.

James A. McCarthy, associate professor of civil engineering at the University of Notre Dame, has been elected chairman of the Indiana State Board of Registration for professional engineers and land surveyors. Mr. McCarthy has been a member of the Board since 1956.

Frank R. Sherman, until recently construction engineer of the Metropolitan Fair and Exposition Authority in Chicago, Ill., has joined the Los Angeles firm of Daniel, Mann, Johnson & Mendenhall, Inc., as operations manager of its International Division. Mr. Sherman will be in charge of the company's overseas projects such as the Third Air Force Installations in the United Kingdom and the design of the world's largest underwater aqueduct for the government of Venezuela. Mr. Sherman served as deputy manager for Architects-Engineers Spanish Bases.

F. R. Sherman

Stevens & Thompson, consulting engineers of Portland, Ore., announce the retirement of **J. C. Stevens** from active connection with the firm. Mr. Stevens, a Past-President of ASCE and co-founder of the firm, will continue to serve it in a consulting capacity. The firm also announces the opening of a Seattle, Wash., office, with Ray C. Charles as resident partner.

Harvey P. Howard, formerly bridge design engineer with Richardson, Gordon, and Associates, of Philadelphia, Pa., has joined the engineering staff of the Delaware River Joint Toll Bridge Commission.

M. B. Nixon, for the past fifteen years engineer in charge of sewers for Atlanta, Ga., has recently been made assistant chief of construction for the city. He will assist in the administration of the Construction Department, but will continue to devote most of his time to sewer and sewage treatment problems, especially supervision of the three-year $11 million improvement program now under way.

Ralph Eberlin, consulting engineer of New York City, announces the formation of a new firm, Eberlin and Eberlin, in partnership with his son **Monroe M. Eberlin.** The organization, located at 123 E. 77th St., New York City will specialize in site engineering and site planning.

Daniel M. Roop, of Memphis, Tenn., announces that he is now actively engaged as a professional engineer offering consulting services in hospital design and engineering management. Mr. Roop has been chief engineer, administrative engineer, and plant engineer on the construction of a number of important hospital structures in the New England area. He has also been project engineer for the Boston sanitary engineering firm, Metcalf & Eddy.

Daniel M. Roop

C. J. Arcilesi has been appointed chief of the Construction Management Branch of the Public Buildings Service, in Washington, D. C. In his new job he will be responsible for the nationwide supervision of the management of new construction projects undertaken by the Public Buildings Service. Formerly, Mr. Arcilesi was assistant chief of the Research Facilities Planning Branch of the National Institute of Health and chief of the Field Operations Division of the Veterans Administration.

C. J. Arcilesi

The New York City consulting firm of Hazen and Sawyer announces the following have been made associates in the firm: **C. Richard Walter,** sanitary engineer; **Francis P. Coughlan, Jr.,** engineer; **Remig A. Papp,** senior engineer; **Joseph N. Rizzi, Jr.,** civil engineer; **John W. Neave,** resident engineer; and **Walter B. Sinnott,** junior engineer.

Maurice L. Albertson, director of the Colorado State University Research Foundation at Fort Collins, and **Thomas H. Evans,** dean of the College of Engineering, are in Bangkok conducting a six-weeks "operational survey," prior to the establishment of a graduate school of engineering in Thailand. Technical assistance by the university will be administered in cooperation with the government of Thailand, SEATO, the International Cooperation Administration, and the U. S. Operational Mission in Thailand.

M. L. Albertson

T. H. Evans

Byron E. Jones, paving engineer and general field engineer of the Portland Cement Association's Los Angeles office, will serve the state of Oregon as part of the association's expansion program. Mr. Jones will have his headquarters in Portland, under the supervision of the Seattle district office.

D. Allan Firmage returns to the faculty of civil engineering at Brigham Young University in Utah after an eighteen-month leave of absence. While on leave he served as chief bridge design engineer for Capitol Engineers in Saigon, Vietnam.

(Continued on page 26)

News of Engineers

(Continued from page 25)

Richard P. Gurley has been named sales administrator of the construction products division of the L. B. Foster Company's Chicago office. He has been associated with the California State Highway Department and the Highway Products Division of the American Steel and Wire Division of the U. S. Steel Corporation. **Donald J. Cier**, former sales engineer for the Armco Drainage & Metal Products, Inc., has joined the sales staff of the firm's Los Angeles office, and will cover the Northwest.

William F. Cox, Jr., is the new field engineer for the firm of Ammann and Whitney on the Washington International Airport, at Chantilly, Va. Previously Mr. Cox served for two years as resident engineer for Parsons, Brinckerhoff and Macdonald on the Richmond-Petersburg Turnpike.

Eugene A. Bartkus has assumed the position of chief engineer of John F. Meissner Engineers, Inc., of Chicago, Ill., in a major reorganization of executive personnel to handle the company's expansion program. Mr. Bartkus has been with the company for nearly ten years, and prior to his promotion served as assistant chief engineer.

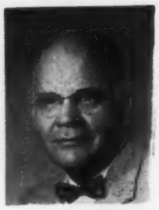
Henry Hudson Myers, Jr., has been appointed associate engineer of the Baltimore, Md., firm of Whitman, Requardt and Associates. Mr. Myers, a member of the firm since 1951, has supervision over the design of highways, bridges, air fields, storm drains and utilities. Other associate engineers include **Ernest C. North, Kenneth A. McCord, Roland A. Clark, Charles F. Millard**, and **Roger T. Powers**.

J. C. Lamb, III, has been named sanitary engineer for the Organic Chemicals Division of the American Cyanamid Company, of New York City. Dr. Lamb has been with Cyanamid since 1955, when he joined the Bound Brook plant. Previously he served on the faculties of Virginia Military Institute and Massachusetts Institute of Technology.

Richard Dudley Field, a seventeen-year veteran with the Army Corps of Engineers, has been named the new chief of the engineering and design branch of the Southwestern Division with headquarters in Dallas, Tex. For the past three years, Mr. Field was chief of the Passamaquoddy Tidal Power Survey Division of the Corps' New England Division.

Calvin L. Garrett, consulting engineer with Scott & Associates, of Oklahoma City, Okla., and **Harold B. Wenzel**, chief engineer with the Dolese Company, of Oklahoma City are among those selected as directors of the newly organized Oklahoma chapter of the American Concrete Institute.

Elmer S. Barrett, owner of Elmer S. Barrett Associates, of Chillicothe, Ohio, was recently elected president and chief engineer of Photronix, Inc., of Columbus, Ohio, an engineering service organization specializing in aerial photogrammetry and electronic computation. Mr. Barrett was also elected chairman of the Board of Managers of Barrett Associated Engineers, a consulting engineering partnership associated with Photronix.



E. S. Barrett

George F. Sowers, vice president of the Law Engineering Testing Company, Atlanta, Ga., is in India on a three-month assignment to train graduate Indian civil engineers at Roorkee University as part of a program to develop Asian water resources. Mr. Sowers is also an engineering professor at Georgia Institute of Technology in Atlanta.

Freese, Nichols & Turner, consulting engineers of Houston, Tex., announce the opening of an office in Port Arthur, and a change in the firm name to Freese, Nichols, Turner & Collie.

Russell P. Westerhoff, a vice president and director of Ford, Bacon & Davis, Inc., of New York, has been appointed chief engineer of the firm. A member of the firm since 1928, Mr. Westerhoff was formerly manager of the engineering department and has been assistant manager of the construction department. **Stuart R. Fleming** has been made manager of the engineering department. He has served as an engineer in the construction department and been manager of the valuation department in the twenty years he has been with Ford, Bacon & Davis.

R. P. Westerhoff

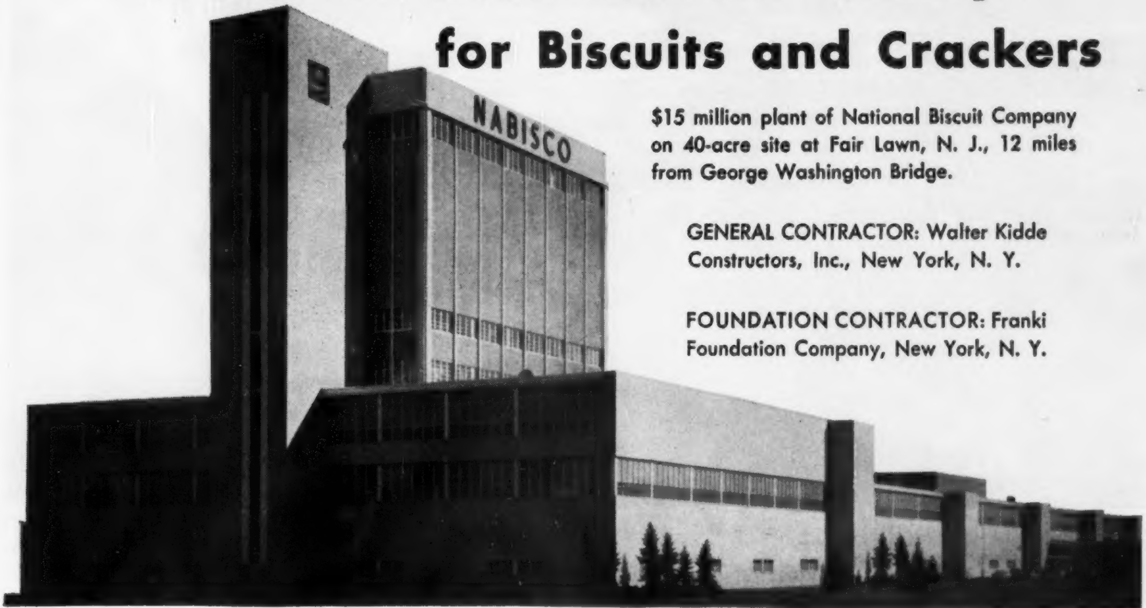
S. R. Fleming

John Duba, Jr., after forty-two years as top civilian with the Navy, retired recently as director of the design department, Public Works Center, Newport, R. I. His most important assignment was in 1940 as senior civil engineer and chief civilian assistant to the officer-in-charge of construction of the Quonset Naval Air Station and the Advance Base Depot at Davisville, R. I. Mr. Duba is now associated with the ATR Construction Company of Newport.

(Continued on page 112)

FRANKI FOUNDATIONS

at World's Most Modern Bakery for Biscuits and Crackers



$15 million plant of National Biscuit Company on 40-acre site at Fair Lawn, N. J., 12 miles from George Washington Bridge.

GENERAL CONTRACTOR: Walter Kidde Constructors, Inc., New York, N. Y.

FOUNDATION CONTRACTOR: Franki Foundation Company, New York, N. Y.

164-Foot High Tower Section for Raw Materials Storage and also 2-Story Laboratory Built on Franki Displacement Caissons Bearing in Granular Subsoil.

This newest of 10 Nabisco bakeries and a major unit in a $180 million expansion and modernization program was designed and its construction supervised by the Company's own engineering department.

When borings for the tower section at the north end of the plant showed granular subsoil, Nabisco engineers recognized that displacement caissons with expanded base footings would provide a solid and most economical foundation. The tower is primarily for storage of 75 carloads of raw materials with mixing departments in the lower area.

After Franki engineers completed additional soil tests, two rigs installed 407 Franki Displacement Caissons at depths averaging 20 feet below grade, at a rate of better than 6 per day per rig during 36 driving days of cold December and January weather. Groups of caissons carry column loads as high as 940 tons.

Later, Franki engineers were called in again, this time for the foundations for an adjoining two-story Research and Development Laboratory at the south end of the four-block long bakery. A single rig installed 130 Franki Displacement Caissons in 20 driving days at average driven depths of 21 feet.

These two Nabisco installations, like other Franki work, were quoted on a lump sum basis without qualification or payment for excess footage. All work was guaranteed.

Consult Franki engineers on your foundation problems.

FRANKI FOUNDATION COMPANY

Displacement Caissons • Pressure Injected Footings • Tube Piles • Underpinning • Soil Investigations

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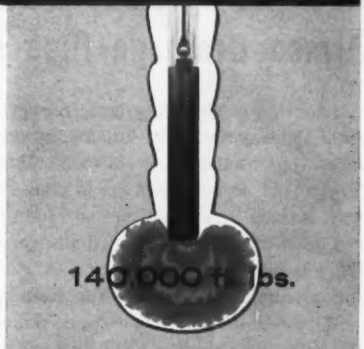

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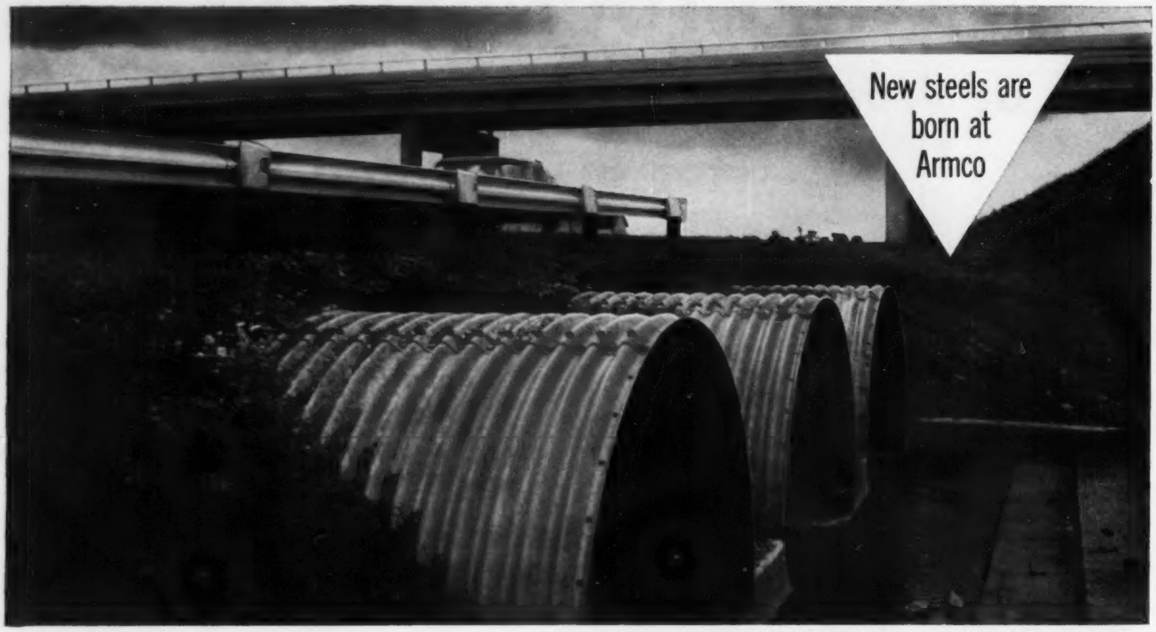
*"Dry" concrete is defined as zero slump concrete using approximately 3½ gallons of water per bag of cement.



Three lines of Armco MULTI-PLATE® Pipe-Arch provide waterway for creek crossing new relocated freeway in Ohio.

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Armco Drainage Pipe serves both relocated freeway and old highway

A relocated modern four-lane freeway now replaces the original 1907 highway. On both, Armco Corrugated Metal Drainage Structures were installed. The old road still carries local traffic, and the 50-year-old Armco Pipes are in good condition. On the new freeway, Armco Pipe again met all requirements.

This story is being repeated all over the country. *Proved durability* is influencing selection of Armco Drainage Structures for the country's newest highways, freeways and expressways.

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For a quick, concise picture of the complete line of Armco Drainage Structures, send in the coupon for our new folder. Armco Drainage & Metal Products, Inc., 5549 Curtis Street, Middletown, Ohio.

Taken in 1923, this photo shows twin Armco Pipes installed in original highway in 1907.

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. . . . . Am-Soc Briefs

▶ ▶ Orchids to our Sections. . . . To the Los Angeles Section for its masterly hosting of another ASCE Convention. Over 1,600 enjoyed the chance to brush up on technical progress the pleasant way, via 150 informative papers, and to study first-hand civil engineering problems peculiar to the Los Angeles area. . . . To the Alabama Section for its enviable record in the notoriously troublesome matter of collecting dues. In 1958 it collected from 100 percent of its members — an impressive feat, especially in a Section with 465 on its rolls.

▶ ▶ Cited for honors, also — the energetic Sections that have met their quotas in the ASCE Member Gifts campaign for the United Engineering Center and are pushing on toward a possible 200 percent. There are ten of them now (February 20): Kentucky, Lehigh Valley, Nashville, Cincinnati, Columbia, Philadelphia, Hawaii, Rochester, Ithaca, and Southern Idaho. . . . Late in January District 4 topped its quota of $34,000 — the first District in ASCE to attain such status.

▶ ▶ Cleveland will be backdrop for two big events this spring. . . . The 1959 Nuclear Congress is set for the Public Auditorium, April 5-10. There are over thirty sponsoring societies, with EJC the coordinating agency. . . . The ASCE Summer Convention will be held in the Hotel Cleveland, May 4-8 — vide the promising program in this issue.

▶ ▶ Speaking of Cleveland, there will be a General Business Meeting of the Society on May 6, during the Convention. At this session the affirmative vote to change ASCE membership designations must be canvassed to comply with a requirement of the Constitution. The mechanics of the change-over in designations is explained on page 79.

▶ ▶ Jet Age Airport Conference. . . . This spring the Society takes cognizance of the civil engineering problems involved in designing and building for the jet age, with its Second Jet Age Airport Conference, to be held in Houston, Tex., May 20-22. Co-sponsors are the ASCE Air Transport Division and the Texas Section's Houston Branch. Cooperating with them are the Airport Operators' Council and the Air Transport Association. Wives will be welcome, too — they will be glad to know that the famous Shamrock-Hilton Hotel will be meeting headquarters and that the ladies of the Houston Branch have their interests at heart. . . . "Civil Engineering" will devote the May issue to important papers on the subject of Air Transport prepared by top people in the industry. One paper will deal with the huge new Washington International Airport at Chantilly, Va.

▶ ▶ A reminder. . . . The 1958 Index to "Civil Engineering" is ready and each member is entitled to a free copy. Request should be made (by postcard, if possible) to the Executive Secretary.

do you know that

New York is menaced by soot? Los Angeles has its smog and Manhattan has soot—an accumulation of 107.3 tons per square mile for each month in 1958, an increase of about 6 tons a month over the 1957 figures. In the other boroughs there was a slight decline in sootfall. The dust count was the lowest since measuring started in 1956, and smoke shade, a measure of the air's resistance to light, was the lowest since 1955. There was more carbon dioxide than in 1957, but less of the other gases that pollute the air. Source for this is the New York Department of Air Pollution Control.

■ ■ ■

The Free Nations have added more steel capacity than the Iron Curtain countries? Between 1955 and 1958 the Free World increased its steelmaking capacity by 53.8 million tons, while Russia and its satellites added 19.8 million tons. During this period U.S. capacity rose by nearly 14.9 million tons, while Russia added 10.3 million tons. (However, Russia and China have just announced major expansion programs.) World steelmaking capacity, at 372.6 million tons, has increased nearly 25 percent over the 1955 level. U.S. annual capacity is 147.6 million tons. The report comes from the American Iron and Steel Institute and is based on United Nations figures. With shortages a thing of the past, there is no need for engineers to spare steel in their designs.

■ ■ ■

Brazil is building a road to connect its new capital with the rest of the country? When Brasilia, the new capital city, is dedicated in April 1960, a 379-mile road linking it with roads in the coastal area will be ready, too. One of the biggest fleets of construction equipment ever assembled in South America is pushing the $36.3 million project to meet the deadline. The road, consisting of a soil-stabilized base with bituminous wearing surface, will connect Brasilia with Belo Horizonte, center of the country's paved road system.

■ ■ ■

Engineering school enrollments are slumping? While overall college enrollments rose 6.2 percent in the fall of 1958, freshman engineering enrollments were off 11 percent. A 3 percent decrease in freshman civil engineering enrollments—from 26,255 to 25,491—is almost balanced by an increase in graduate enrollments. The Department of Health, Education, and Welfare makes no secret of its concern over the situation, which Secretary Arthur S. Flemming calls "a serious setback in a field of education vital to our national security."

■ ■ ■

An English Channel tunnel is perfectly feasible? This is the consensus of the English Channel Tunnel Study Group that has been exploring the seabed by seismic methods. The results of investigations made around 1880 have also been studied, and the borings and pilot tunnel which have been submerged since that time have been pumped out and found to be in good condition. The next step will be to determine methods of construction and approximate costs. Chicago consultants, DeLeuw, Cather & Company, have been retained to study costs. Whether the tunnel will be for rail or road or both will depend on the outcome of efforts to develop a satisfactory ventilating system. The Study Group consists of representatives of the Suez Canal Company, the French and British Channel Tunnel Companies, the International Road Federation, and Technical Studies, Inc., of New York.

■ ■ ■

Engineers should be thinking of the problems involved in building on the moon? A base on the moon by 1969 is on the U.S. timetable, according to the Air Force, which has announced its space program for the next decade. Fantastic, yes, but possibly no more so than the miracles the engineering profession has chalked up in the past century.

■ ■ ■

Federal highway laws have been codified? For the first time in almost forty years all the Federal laws relating to Federal-aid and other Federal highways are easily accessible in one act. This is the result of enactment of Public Law 85-767, bringing together all the Federal highway laws into one piece of legislation, Title 23, United States Code Highways. Since passage of the first Federal-Aid Road Act of 1916, more than 40 separate highway laws have been enacted, exclusive of the many appropriation acts. Thanks for this item to Purdue University's "Highway Extension News."

■ ■ ■

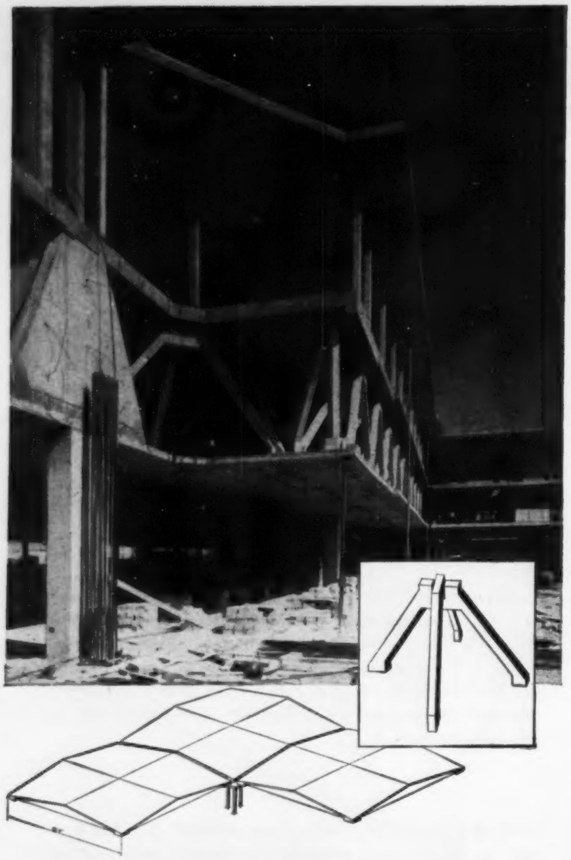
Fires annually take a toll of 12,000 lives and destroy a billion dollars worth of property? Every phase of fire prevention and protection will be studied in the Midwest Research Institute's new fire laboratory. The first project is a $55,000 one-year program on high-energy boron fuels underwritten by the Wright Air Development Center.

■ ■ ■

From $600 million to $1 billion is spent annually on military and civilian instruction books? This makes U.S. industry the largest technical publisher in the world—estimated to employ more writers, editors, and publication managers than all other publishing, advertising, and public relations activities combined. So says Roswell Ward, technical publications management consultant (of Bantam, Conn.), in releasing a publication entitled "Problems in Technical Publication Management—A Preliminary Survey."

SPACE PLATFORM

for American Industry



HYPERBOLIC PARABOLOID roof sections are composed of warped thin-shell slabs, cast in place. V-TETRAPODS (above) are four-footed diagonal supports for space frame, precast at the site. Concrete met specified strengths up to 5000 psi.

Rigid Space Frame Between Floors Gives New Plant Broader, Brighter Work Areas

● Quicker than you can say "multiple hyperbolic paraboloids on a V-tetrapod plenum," Texas Instruments Incorporated has a new, seven-acre plant in Dallas—an outstanding example of tomorrow's factory in operation today. It represents the first use in American industry of the "space frame" and the "umbrella roof"—two new architectural forms made practicable by the versatility of concrete.

The space frame—located between the administration-engineering floor below and the manufacturing floor above—acts like a giant, three-dimensional truss. Nine feet high and braced by slender, precast tetrapods, this rigid frame permits large 63-ft. bay areas on both floors, and contains all the pipelines which supply some three dozen utilities to any part of either floor through approximately 3,000 access holes.

The thin-shell concrete roof is formed of cast-in-place hyperbolic paraboloid sections—permitting exceptionally large, well-lighted areas with a minimum of columns, and producing a versatile structure which can readily be expanded in any direction by adding similar units.

The total result of this imaginative use of modern materials and methods was a quickly-erected, readily expandable structure with an easy, open atmosphere far removed from the dark factories of the past.

Semiconductor-Components Division
TEXAS INSTRUMENTS INCORPORATED
Dallas, Tex.

Architects:
RICHARD S. COLLEY, Corpus Christi, Tex.
O'NEIL FORD, San Antonio, Tex.

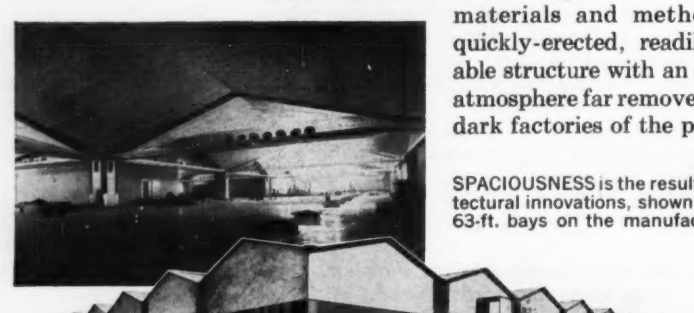
Associates:
A. B. SWANK, Dallas, Tex.
S. B. ZISMAN, San Antonio, Tex.

General Contractor:
ROBERT E. McKEE, INC.

Paving Contractor:
UVALDE CONSTRUCTION CO.

Ready-Mix Concrete supplied by:
WAMIX INCORPORATED

All of Dallas, except where indicated.



SPACIOUSNESS is the result of two architectural innovations, shown in the broad 63-ft. bays on the manufacturing floor.

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Computers and the Engineer Personality

ELMER K. TIMBY, M. ASCE, *Partner, Howard, Needles, Tammen & Bergendoff, New York, N. Y.*

The role of electronic computation in civil engineering from the point of view of the computing system has been exhaustively covered in talk and the technical journals. Less thought has been focused on the civil engineer himself, and the effect upon him of the electronic concept of engineering. I pose the question, "How will electronic computation affect the personality and professional performance of the civil engineer?"

I place "personality" before "professional performance" because we are people first and professional engineers second. In the future the electronic computer will absorb a larger and larger percentage of the work that formerly occupied so much of an engineer's effort. The work absorbed by the machines will be the hard, routine, limiting type that was so time consuming. The computer is a high-speed slave, doing what it is told to do quickly, precisely, and without thinking. The civil engineer is in the position of having much of his familiar working pattern disappear, with nothing similar to replace it. For any human being, such a drastic change can be quite important —even disturbing. I see a very real challenge arising in terms of the civil engineer's ability, not merely to accommodate and adjust to the computer, but also to utilize positively the creative talent that he will now have the time and the tools to develop.

Several years ago, in an article in the *Bent* of Tau Beta Pi, Dr. Charles E. Goshen, a practicing psychiatrist, evaluated the "Engineer Personality." The following is quoted from that article:

"The engineering profession is one area of human endeavor wherein there is a very high consistency in so far as the character traits which its members have in common are concerned. In other words, there exists an 'engineer personality.' As with all the other typical personalities in various occupations, it must be kept in mind that it is not the occupation itself which determines the personality, but rather it is the type of personality which chooses the occupation in question.

"The engineer's most obvious characteristic is his precision, his meticulousness, his attention to detail and accuracy, and his perfectionism. Another striking quality is his intelligence. Once we get to know an engineer better we appreciate that his intelligence tends to be used in a very specialized way. Specifically, we find that what he knows a lot about is mechanical principles and what he knows little about is human principles. His success in mastering mechanics tends to lead him farther away from achieving competence in dealing with people. Characteristically, for example, he builds an airplane which is too complicated for a human being to fly.

"Another dilemma presented by the engineer personality lies in the fact that these personality traits tend to interfere in a serious way with the very jobs for which engineers are trained and hired to do. The engineer is most useful to his organization when he has new ideas and develops them in collaboration with other new ideas. Engineering problems today are generally too complex to permit of their solution by a single person, but they must necessarily be solved through the cooperation of many specialists. However, the engineer's fear of taking a chance with a new idea based on his dread of failure and criticism often prevents him from coming up with the new ideas his organization needs. His difficulty in collaborating with others stands in the way of his developing ideas with the cooperation of others. His exacting demand for accuracy (or, rather, his fear of inaccuracy) tends to make his ideas impractical."

Although some of us may have mixed reactions to a psychiatric evaluation such as that just quoted, we must recognize that a demand for accuracy and meticulous detail is strongly present in the typical engineer. That demand often prevents him from proper evaluation of broad and important engineering advancements.

Such restraints are stronger in civil engineering than in other fields. Other engineers can build and test prototypes as a part of the development stage. They perfect samples

and then go into mass production. Such a process precludes failure of the final product produced for the public. In civil engineering, the first product is the final production of a massive project. It stands or falls on its own. The career of a practicing civil engineer rides with each of his completed projects. Such a pattern is naturally quite sobering.

I am not advocating that we abandon necessary precisions, but engineers have tended to use "extra decimal places" regardless of their relative importance. An old cliché states that "an engineer is a man who can do for five dollars what any damn fool can do for ten." We have spent much time in achieving that end through laborious computations. Our passion for detail becomes understandable when perceived from the human personality viewpoint. We might say that this demand for accuracy and order has been a hobble that has prevented the engineer from fully striding forward, and our successes have been in spite of this tendency, and not because of it.

The electronic computer, with its built-in and programmed accuracies and precision, and its ever-increasing ability to absorb more and more work, is forcibly removing this hobble, challenging the engineer to act with scientific maturity. We are faced, therefore, with the problem of personal reorientation during an opportunity for tremendous professional growth.

We have three possible ways of dealing with this problem. First, we can deny its existence. Too often this has been the case in the past. Second, we can attempt in some way to transfer much of our dependence upon detail and accuracy to the electronic computer, for example, by trusting its answers implicitly. This will delay our facing the problem fully but will create an inherently unstable situation that one day must collapse. And third, we can have the courage to face the threat and discomfort that accompany any self reappraisal and all growth, and thus release the creative potential that for so long has remained dormant. I have no simple solution for accomplishing this third step. I do recommend that the profession give serious thought to it.

(This extract is from a paper presented on November 20, 1958, before a conference sponsored by the Committee on Electronic Computation of the Structural Division and the Kansas City Section, both of ASCE, at the Continental Hotel, Kansas City, Mo.)

FRANK WORSHAM, Jr.,

Partner, Worsham Brothers,

Contractors, Corinth, Miss.

Mutual respect, key to good engineer-contractor relations

Having been both an engineer and a contractor, I am especially interested in the subject of good engineer-contractor relations. My experience during the past twenty-five years has been divided nearly equally between the two fields, mostly on construction of Mississippi Highway Department projects. Both types of experience have led to the conclusions expressed here.

While serving as project engineer on numerous highway projects, I often found myself riding through one of them with a friend. Usually it was with a great deal of pride that I would say to him, "I built this road." However, after changing over from engineer to contractor, I held a somewhat different view as to who had accomplished the work. When riding through projects for which I had held the contract I would still take a good deal of pride in saying, "I built this road."

In each case I think I was honest in my belief that it was I who deserved the credit for carrying out the work. However, as we grow a little older and our ego mellows a little, we often see things a little differently. I see now that the construction of these projects was the product of the combined efforts of the engineer and the contractor. Now when I ride with a friend through a completed project I say, "I had a part in the construction of this road." With this viewpoint in mind I shall discuss what seem to me to be important factors in the engineer-contractor relationship.

Generally speaking, the function of the engineer is to formulate an ideal and from it to create a reality. More specifically, the engineer's function is to formulate plans and specifications for the construction, to let contracts for the actual work, and to supervise it until completion.

In general, the function of the contractor is to undertake the actual physical execution of the work, from the point of a formulated ideal to that of a created reality, or more specifically, in accordance with the plans and specifications.

Component parts of a team

This quick look at the functions of the two agents makes it evident that there is no real justification for the existence of the engineering profession without that of a corresponding construction industry. Vice versa, there is no justification for the contracting industry apart from a corresponding engineering profession. The two are closely knit as component parts of a team whose purpose is to bring to reality a completed work, such as a modern highway for the use of the traveling public.

When the traveling public is introduced into our thinking, we at once realize that here is a very important factor. Here is the man who ultimately foots the bill for the activities of both engineer and contractor. Here is the employer of both. Our picture of the relationship now becomes clearer. We

might say, "The engineers and contractors, both employed by the same agencies, have the same common purpose in view, the completion of a modern highway which has been properly planned and constructed." I am using highways as an example, since this is the field with which I am most familiar.

Since the engineering profession and the contracting industry are two separate and distinct groups, we must at this point concede that proper relations must exist between them if either is to accomplish its function. What should proper relations be based on? What can be done to improve these relations?

The whole idea of engineer-contractor relations could be summed up by saying, "Proper engineer-contractor relations can exist only when each contingent has the complete respect of the other." This respect must be industry wide, and certainly it must be something that has been *earned* and not merely granted in name only.

The engineer should not expect this respect simply because of his title. It goes far deeper than that. Regardless of title, he must continually exercise his duties on the high plane that has been established throughout the decades by his entire profession in order that he may earn and increase this respect.

Likewise the contractor should not expect this respect simply because he owns a pick-up truck with his name on it and the word "Contractor" written below. He also must continually exercise his duties on a plane that will earn and increase respect for his industry.

The two components have made great strides in recent years in earning the respect of each other. Our specifications illustrate this by emphasizing two points: (1) the authority of the engineer and (2) the responsibilities of the contractor. In great detail the specifications point out that the authority vested in the engineer is rather all-inclusive and rather final. The engineering profession for years has assumed this cloak of authority, and in my opinion has worn the cloak very becomingly. It has assumed and exercised this authority to such an extent and in such a manner that it has come to be highly respected. This is because the respect has been *earned*.

Now we come to the responsibilities of the contractor. These are great and small, too numerous to elaborate on here. The specifications clearly and concisely state that the contractor is bound to accept full responsibility for his contract. This responsibility often affects not only his own operations but also those of the engineering personnel and of the traveling public as well. In my opinion, contractors have assumed this responsibility in recent years in such a way that the former questions regarding it no longer arise. In other words, the ability of the contracting industry to assume the varied responsibilities demanded of it today has become not only accepted but respected. This respect has also been *earned*.

Thus we cannot doubt that engineers and contractors have come a long way together in establishing proper relations based on a mutual and earned respect. There are specific reasons why each has earned the respect of the other. Actually these reasons are not too numerous to mention nor are they very hard to ascertain. Each of the qualities and elements involved, although good in itself, must be combined with all the others to produce the desired results.

Integrity

Probably no factor should be stressed more strongly than respect for the integrity of the other party. This quality of integrity means moral soundness, or uprightness, or just plain honesty. Integrity when put to the test will win out over such human weaknesses as personality problems and personal likes and dislikes. If we continue to try to solve our differences with a genuine respect for the integrity of the other party, those differences will eventually be resolved on the basis of merit—after all the only true solution. Continued respect for the integrity of others can have only one basis—continued honesty with one another. We cannot overlook this quality in trying to keep our relations on a high plane.

Intelligence

Both the contractor and the engineer have learned in the past, sometimes from bitter experience, that the other party is no fool. Each has learned that if he does not respect the intelligence of the other he will soon find himself trapped and engulfed by his own follies. I do not mean to imply that there should be a continual battle of wits between the two. However, my own respect for both parties will cease when there are no honest differences of opinion between them.

The important thing is to develop within our own ranks the ability to meet such situations with good common sense, to control our behavior adjustments, and most of all to understand the interplay of the facts presented. Then we will be guided toward a satisfactory solution. That is really what intelligence means to me. If, when differences arise, we will be patient enough with each other to apply the combined intelligence of both parties to the problem at hand, there is little doubt but that we shall soon find our way to a satisfactory solution. We shall also find that our relationship has become more closely knit through our mutual respect for the other's intelligence.

Sense of fairness

Most of us carry on our daily lives among our fellows in the belief that they will meet us half way. We are greatly enthused when we feel we have been treated fairly and keenly disappointed when we believe we have been treated unfairly. To maintain one's sense of fairness many times presents a problem to engineer and contractor alike. More often than not one or the other becomes biased for personal reasons or, particularly in the case of the contractor, for personal gain.

These are the times when the cards are really on the table. These are the times when one's respect for the other's sense of fairness has to be earned. These are the times when we can make it easier for ourselves the next time—when we may be the one who is biased. Engineers and contractors have a continual problem here of self-discipline if they are to earn each other's respect for a sense of fairness.

Personal rights

Very few engineers or contractors were forced into their vocations. Most had the privilege of choice. Each chose a vocation that offers certain personal rights and privileges. Not only must both parties guard for themselves these precious personal rights but each must make a determined effort not to encroach on, or become jealous of, the personal rights of the other. A lack of respect for the personal rights of others will assuredly send our relationships into a tailspin, with certain disaster ahead.

If we learn to respect one another and to earn this respect in the ways that have been discussed, in the long run there will be no problems of cooperation. Cooperation will come naturally.

We of the engineering profession and of the contracting industry have a lot of narrow roads behind us, but the future holds vistas of many broad highways—broad highways that present a broad challenge. And this challenge can be met, provided each side can be broad enough to earn the respect of the other.

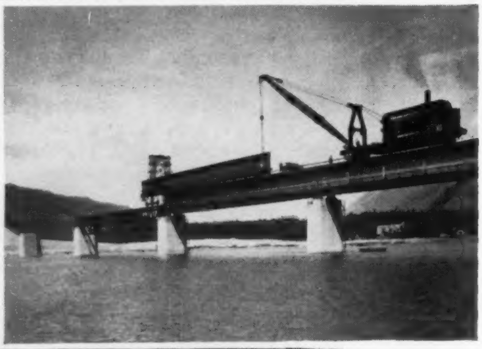
(This article is based on Mr. Worsham's address at the Fourth Annual Mississippi Highway Conference, held at the University of Mississippi in 1958.)

Railway and highway relocation

G. R. LATHAM,
Chief Structural Engineer

W. G. SAVILLE, A.M. ASCE,
Principal Structural Engineer

Piers for railway bridge No. 73 were constructed across a narrow peninsula, which was excavated later. Peter Kiewit Sons Co. was the contractor.



Lightweight trusses were set by Kansas City Bridge Co. derrick car, then used to carry one end of 120-ft girder to position in bridge No. 73. Fabricator was Kansas City Structural Steel Co.

Eight 120-ft spans carry the Northern Pacific over the upper end of the Cabinet Gorge Reservoir on bridge No. 73.

The cost of railway and highway bridges required as a part of the Noxon Rapids Hydroelectric Development was about 9 percent of the total cost of the project. This unusually high proportionate cost was due to such factors as generally unsatisfactory foundation material and a narrow valley confined between the steep foothills of the surrounding mountain ranges. These factors limited the relocation of the portions of the railway and highways to be inundated by the Noxon Rapids Reservoir, resulting in some interesting solutions to foundation and structural problems.

Noxon Rapids Dam is being built for The Washington Water Power Co. It is located near Noxon, Mont., on the Clark Fork River at the head of the reservoir of the Cabinet Gorge Hydroelectric Development owned by the same company. Engineering design and management of construction are handled by Ebasco Services Inc. The new dam will impound a reservoir extending 38 miles to the tailwater of the Montana Power Company's dam at Thompson Falls.

The floor of the Clark Fork Valley is covered to a considerable depth with heterogeneous mixtures of clay, sand, gravel and boulder deposits from the glacial outwash of prehistoric Lake Missoula. This soil pattern was responsible for many of the difficulties encountered in grading for the relocated railway and highways and in securing suitable foundations for structures made necessary by these relocations. A total of twenty miles of the main line of the Northern Pacific Railway was relocated and ten miles of relocation was required for U.S. Highway 10A. A number of forest and country roads, totaling about twenty miles, also had to be relocated.

Embankment slopes on existing and relocated railways and highways, which are to be submerged in the Noxon Rapids Reservoir, required protection by riprap or were of rock-fill construction. The total cost of relocation and embankment protection work was $22,000,000, of which the cost of the railway and highway bridge construction and alteration, including bank protec-

at Noxon Rapids

Ebasco Services Inc.
New York, N. Y.

Aluminum trusses on extended supports carry erection of 360-ft railway bridge No. 57 across a boulder-filled gorge. Superstructure contractor was Kansas City Structural Steel Co.

tion at the abutments, was about $10,-000,000.

Originally the main line of the Northern Pacific Railway ran along the south side of Clark Fork and crossed the site of the dam. About six miles below Thompson Falls, but still within the limits of the Noxon Rapids Reservoir, the railway crosses to the north side of the Clark Fork River, Fig. 1. The major relocation work was required around the dam above the maximum elevation of the reservoir.

Surveys and cost estimates were made for a relocation of the railway at a higher elevation on the south side of the river. The south-side relocation would have required deep and long rock cuts or tunnels. The higher summit elevation which would have been required to obtain suitable supporting ground and to place the railroad above the crest of the dam would have increased the length of the relocation considerably. The long cuts or tunnels would have required excessive maintenance and snow removal. These features would have made both construction and operation costs excessive.

The north-side relocation was cheaper even though it entailed the new construction of two major bridges, two bridges across tributary streams, and three highway overpasses. This route had the advantage of a lower summit elevation, shorter length and shorter overall length of through cuts. The snow removal work on the north side will be greatly reduced since the railway exposure is to the south throughout the length of the relocation.

A contract negotiated with the Northern Pacific Railway Co., provided for a 3-deg maximum curvature and a 0.4-percent maximum grade, with compensation downward for curvature. These requirements are quite rigorous for the terrain traversed by the relocated railway.

All railway bridges were designed in accordance with AREA Specifications and specific requirements of the Northern Pacific Railway for an E-65 live load, and a seismic load of 10 percent of gravity. An ice loading of 10 tons per lin ft, applied at maximum reservoir

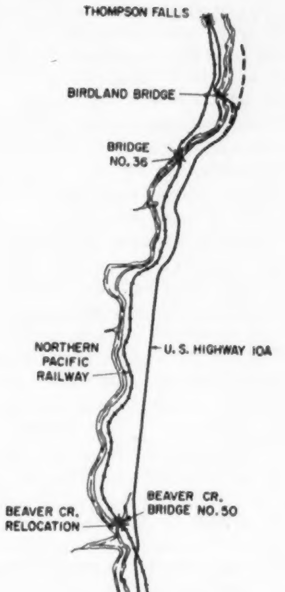


FIG. 1. Noxon Reservoir on the Clark Fork River in Montana, a tributary of the Pend Oreille and the Columbia Rivers.

elevation, was included in the design for piers and abutments in the Cabinet Gorge and Noxon Reservoirs. Sverdrup & Parcel were retained by Ebasco as consulting engineers on the design of the railway bridges. All designs and plans were reviewed and approved by Northern Pacific Railway engineers.

The railway bridges are numbered to conform with the number of the nearest milepost. Elevations refer to sea level datum.

Bridge No. 73

A crossing of the upper end of Cabinet Gorge Reservoir just below Noxon Rapids Dam was necessary. The low-level crossing site finally agreed upon is about 3,000 ft long from shore to shore. Some 2,000 ft of the crossing next to the south shore was through water varying in depth from 10 to 40 ft, and the remainder of the crossing was through relatively shallow water, having an average depth at normal reservoir elevation of 5 ft.

Comparative estimates indicated that the most economical treatment for this crossing would be to place a rock fill from the beginning of the relocation to within 960 ft of the north shore with a bridge consisting of eight 120-ft open-deck plate-girder spans on reinforced concrete piers and abutments constructed in shallow water between the rock fill and the north shore. The reservoir flow was then to be diverted through a new channel dredged under the bridge.

Bridge piers would thus be constructed on land to be later excavated. A trench was first dug along the pier line to final channel elevation and a sheetpile cofferdam used for additional depth at the piers. The piers are supported on concrete-filled steel-shell piles driven in a stiff clay soil. When the substructure was completed, the remainder of the channel was excavated and flow diverted so that the rock-fill section of the crossing could be completed.

The superstructure girders were erected with a traveler mounted on the completed railroad track. Temporary steel trusses were erected between the abutments and the piers; the girders were slid along the temporary trusses

and set in correct position on the shoes. After cross frames and diagonals were placed and riveted, the ties and track were laid and the traveler moved to the next span. Thus the entire superstructure was completed, except for painting, as the traveler advanced.

Bridge No. 57 crosses the Noxon Rapids Reservoir on the relocated line about eight miles above the Noxon Rapids Dam, where the river flows in a narrow gorge with the stream bed about 150 ft below the floor of the valley. A relatively short bridge could be constructed at this location, and only low approach fills were required.

The bridge selected was an open-deck type (Fig. 2) with a 360-ft through-truss span flanked on each end with 120-ft deck plate girders and 61-ft deck-plate-girder end spans. The soil at the bridge site consists of sand and gravel with some clay seams, and has a great many large boulders on the surface and scattered beneath the surface to a considerable depth. The boulders throughout the substructure foundation areas greatly increased the cost.

Footings for piers and abutments for the approach spans are supported on steel H bearing piles, which were driven to safe bearing with considerable difficulty because of the boulders encountered. Foundations for the piers supporting the truss span were constructed by consolidating in place, with intrusion grouting, a volume of material extending 63 ft below the bottoms of the footings. The pier footings were formed with two intersecting circular sheetpiling cells each 32 ft in diameter and 23 ft center to center. The consolidated mass was grouted to 5 ft outside the perimeter of the footing cells at the top, and was sloped outward so that the perimeter at the bottom of the consolidated mass was about 15 ft outside the perimeter of the footing cells. Pier footings were anchored to the tops of the consolidated masses with dowels arranged in circular patterns.

The intrusion grouting was done from the level of the footing bases through pipes of 3-in. diameter extending 10 to 63 ft below that level. Grouting pressures varied from 50 to 150 psi generally, with an extreme pressure of 300 psi in some holes. The total number of holes required for grouting the northerly pier was 355 and for the southerly pier, 295. The total footage of all holes was 24,320 ft, or an average depth of 37 ft per hole.

Bearing values for these piers was determined by means of test loads applied in vertical and horizontal directions in pits excavated to a considerable depth in the consolidated material. Hydraulic jacks were used to apply the test loads, and the bearing values thus obtained were entirely satisfactory. The concrete for the remainder of the piers, above the consolidated mass, was placed by conventional methods.

The 61-ft plate-girder end spans were preassembled and erected as a unit. The 122-ft plate girders were erected by the same method previously described for Bridge 73. Originally the erector planned to erect the 360-ft truss span utilizing falsework bents at each panel point, the bents to be supported on steel H-piles. Delays in the substructure construction, however, forced the erection of the truss span to be rescheduled to take place during the high runoff period for the river, so that driving piles in the river was impractical.

The erection method adopted entailed the use of four aluminum trusses, each 360 ft long, which the erector rented. Steel falsework bearing on steel piling was erected between each pier and the river bank, where piling could be driven above high water. The bents next to the river were cantilevered out to furnish support and avoid excessive deflections of the aluminum trusses. Using high-strength bolts, the inner pair of trusses was partly assembled over the falsework. A center section was skidded into position and cross braced. The floor system, including lower chords and lower chord bracing, was erected on blocking supported on the aluminum trusses. The rails and ties were laid as the floor system was advanced so that the erection traveler could advance with the steel erection.

After the floor system was in place, an additional aluminum truss was added on the outside of each of the existing trusses and braced to it. The web, top chord, and sway-bracing members were then erected; the lower-chord connections were riveted; and the blocking was removed before riveting of the top-chord members. This erection method was used because of the unusually adverse conditions prevailing at the site. The erector could justify the use of aluminum trusses primarily because they were available for rental.

A short relocation of main-line railway about $1\frac{1}{2}$ miles in length was required in the vicinity of Beaver Creek, 6 miles upstream from the end of the major railway relocation. A new bridge consisting of three 120-ft open-deck plate girders on concrete piers and abutments was constructed on the relocated railway. The replaced bridge, an open-deck plate-girder structure supported on steel towers, was dismantled and a part of the steel was used for two other bridges. The other railway bridge work required in the reservoir entailed the concrete encasement of the substructure towers for existing bridge No. 55 across Trout Creek and the concrete encasement of a part of the substructure of bridge No. 36, which crosses Clark Fork River approximately 6 miles below Thompson Falls.

A cableway was used for placing the girders on bridge No. 62, and for placing the steel towers and girders of bridge No. 67. Falsework construction and the use of a mobile crane on rough terrain were avoided by using the cableway since all erection could be done from the railway subgrade on the bridge approaches. The superstructure for these two tributary bridges came from the replaced bridge No. 50.

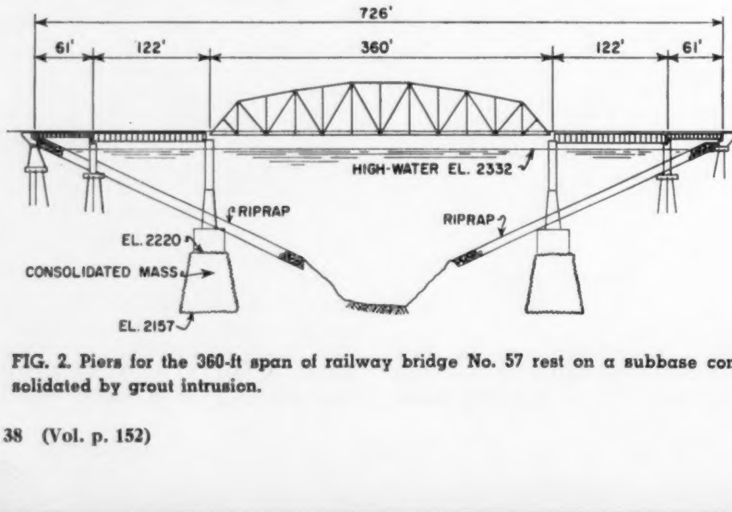


FIG. 2. Piers for the 360-ft span of railway bridge No. 57 rest on a subbase consolidated by grout intrusion.

Highway bridges

The Washington Water Power Co. and the State of Montana Highway Department negotiated a contract that specified design and construction requirements for highways affected by the Noxon Rapids Reservoir. Design and construction of all highway bridges was done in accordance with the latest AASHO specifications and specific requirements of the Montana Highway Department. All structures were designed for a H20-S16 loading. No seismic loading was considered. Clearances for overpass structures were established by the Northern Pacific Railway.

A major highway bridge across the Noxon Rapids Reservoir near the

Towers and girders of railway bridge No. 67 were set by a cableway. Henry Hagman put in the foundation; Hanson & Parr erected the steel.

Bracket on single-column pier reaches out for section of 200-ft girder. Hanson & Parr and the Allied Structural Steel Co. carried out the construction of Clark Fork Highway Bridge.

mouth of Trout Creek was required to replace an existing low-level bridge on which U.S. Highway 10A crossed the Clark Fork River. It was not economical to raise the existing bridge, since it was about 70 ft below the maximum reservoir elevation. The new bridge is at an angle of 45 deg with the river channel, on a 0.9-percent grade.

Piers have a single shaft to avoid skewing of the structure. The lower part of the shaft above the footings is 14 ft square and varies in height. The middle shaft is 11 ft square and 40 ft high. The top 24 ft flares from the square cross-section to form a bridge seat 5 ft wide by 30 ft long.

The abutments are closed-deck skeleton-type reinforced-concrete structures each having an overall length of 72 ft, with curtain walls along the front and sides extending 2 ft below the fill surface. The fill inside the curtain walls of the abutments is sloped in the same plane as the fill outside these walls to balance inner and outer soil pressures. The abutments are each supported on four square columns with two back columns located to provide a cantilever end for the roadway deck. Footings for the abutment columns and for the piers are supported on steel-pipe piles of 12-in. diameter driven to a safe bearing value of 63 tons and filled with concrete.

The two river piers were located in the river where the stream was relatively deep and had a velocity exceeding 10 fps at all river stages. The foundation work for these two piers was done inside a sheetpile cofferdam 40 ft square. Considerable difficulty was encountered in driving the cofferdam sheetpiling because of boulders. Excavation and pile driving were done without unwatering the cofferdams, and tremie seals 10 ft thick were placed before unwatering. After the tremie-seal concrete had set sufficiently, the cofferdams were unwatered and the pipe piles cut off one foot above the seal. The piles were cleaned out and filled with concrete. Dowels inserted in the concrete filling of the piles extended into the concrete footings for anchorage.

The bridge superstructure consists of two parallel continuous five-span plate girders spaced 25-ft on transverse centers. The two end spans are 160 ft long and the three intermediate spans 200 ft from center to center of bearings. The greatest over-all depth of the haunched girders is 12 ft 6 in., the maximum permitted for rail shipment. Straight sections of girders are 8 ft deep, back to back of flange angles. Tops of girders were shop cambered to allow for dead-load deflections.

Floor beams at supports are built-up girders designed for jacking the full dead-load reactions at supports. Intermediate floor beams are trussed frames spaced at 23-ft centers in the end spans and at 25-ft centers in the intermediate spans. Stringers bear on the tops of the floor beams and are continuous for two or three spans. Holes for the attachment of stringers are slotted to provide for unequal expansion between girders and stringers. The concrete deck has a 28-ft clear roadway between curbs and is supported on the girders and stringers.

Fixed bearings are provided for the girders at each end of the center span. The remaining bearings are rockers to provide for equal expansion at both abutments. Expansion devices at the abutments are of the finger type, arranged so that the opening in the top plate is always above the fixed plate of the abutment so that drainage from the slab surface is prevented from reaching the abutment bridge seat.

A unique erection method was used for the superstructure. Erection started with the straight girders set on shoes at the south abutment and on a framed steel bent placed near the girder support points. This steel framing was erected by a crawler crane from the ground. A traveling derrick on the erected steel completed the remainder of the erection from above.

For the remaining girders the support near the forward splice was furnished by a cantilever bracket at each pier. This bracket, framed from structural steel, was attached with steel collars at the top and bottom of the 11-ft-square section of the pier shaft. After the haunched portions of the girders had been placed at a pier and the splice connections bolted, the bracket was dismantled and reerected at the next pier. An extension to the boom on the traveling derrick was used to reerect the bracket. This method of erection was rapid and economical and could be used at flood stages in the river. Also it avoided the driving and extraction of piling for falsework in soil containing many boulders.

An interesting solution to the problem of an unstable foundation was developed for the overpass structure near Rock Creek. The soil at the site consisted of a layer of sand and gravel 16 ft deep, which was underlain with buff clay with an extremely high water content. This clay stratum had an average depth of 30 ft. Since the material was too unstable to furnish lateral support for piles, these could not be used for support of the abutments and piers. The foundation procedure adopted entailed the removal of the clay material to a sand and gravel formation beneath it, over the entire area of the structure. The excavation slopes were flattened to 4 on 1 and the area was backfilled with select material compacted to 95 percent revised Proctor. Soil-bearing foundations were then used for the piers and abutments.

Several other overpass structures posed minor problems of skew but problems of design and construction were readily met.

Ebasco Services Inc. prepared designs and drawing for all the highway bridges. The U.S. Bureau of Public Roads and the Montana State Highway Department reviewed and approved the highway-bridge designs and drawings.

Progress in draft-tube design

HENRY J. HUNT, Chairman of Board and Vice-President, Mead and Hunt, Inc., Madison, Wis.

Observations over the period 1906-1958 inclusive have brought out many points, some good and some bad, in the design, installation, and operation of draft tubes for hydraulic turbines.

In some of the earlier developments, short conical-shaped steel or cast-iron draft tubes were used. Efficiency did not play an important part in the operation of these plants as water was being wasted most of the time. Some plants were operated for only a few hours a day for grinding the farmers' grist. In fact, most plants used vertical wheel settings with complicated and inefficient harnesses, bevel gears, and a horizontal shaft for driving the equipment.

The next step in the elimination of complicated and very inefficient gear drives was the use of horizontal settings for the turbines. By this means two or more turbines could be connected on a single shaft to produce power for pulp grinding or for the generation of electricity. Settings were often arranged so that two or more turbines used a common draft tube, as at Lockport, Ill., Kilbourn (now Wisconsin Dells) and Prairie du Sac, Wis., and many other places about 1906-1912.

Development of the Kingsbury and other thrust bearings for vertical-shaft generators opened the field for modern hydroelectric development. Efficiency of the units became an important item. A 4- to 5-percent increase in overall efficiency of the vertical settings was a major factor in turning to this type for new plants.

Between 1908 and 1912, great strides in turbine design resulted in improving turbine efficiency several percent. Along with this work, the improvement in draft tubes between 1908 and 1924, in addition to the new turbine designs, was changing the economics of hydroelectric development.

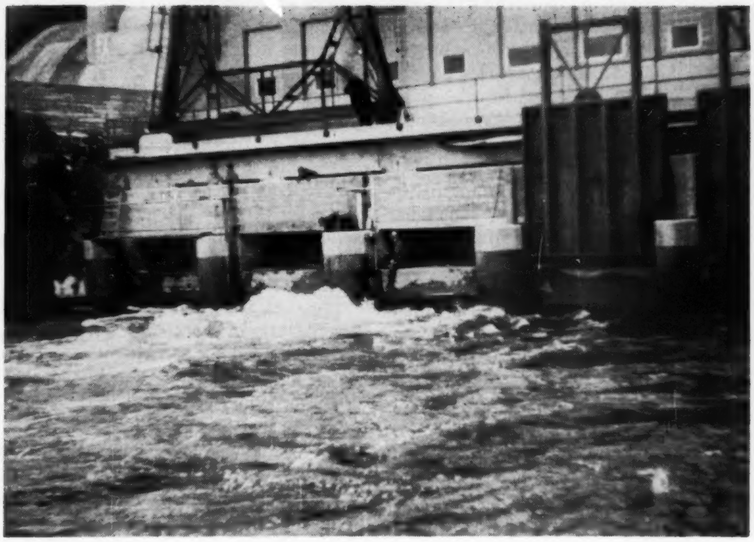
Function and history

The draft tube is that part of the water channel in a waterpower plant which conveys the water from the turbine to the tailrace. In *Water Power Engineering,* Daniel W. Mead, Hon.M. ASCE, made the following statement:

"The function of the draft tube is not only to enable the turbine to utilize by suction that portion of the fall from the wheel discharge to the tailwater level but it should also gradually increase in diameter so as to gradually decrease the velocity of the water after it is discharged from the turbine wheel, thus enabling the turbine to utilize as much as possible the velocity head with which the water leaves the turbine."

The second edition of the *Hydro-Electric Handbook,* by Creager and Justin, gives this comparable statement:

"The function of the draft tube is to conserve for conversion into power by the turbine as much of the remaining head from turbine to tailrace as practicable. Thus the draft tube takes the



Draft tube with 0.4 gate opening (at far left) and with 0.5 gate opening (directly at left) illustrates loss of head due to velocity head which causes 5-ft rise in tailwater at end of draft tube. From 0.6 gate to full gate opening, the power dropped off rapidly.

and performance

water discharged by the turbine at high velocity and then reduces the velocity as gradually as practicable by enlarging the cross section to a low velocity at draft-tube exit below tailwater elevation."

This function of the draft tube is not being followed as closely as it should be by some of the manufacturers of turbines. Because of the general policy that the manufacturer is responsible for the design of the draft tube and must back up his guarantee, the design engineer for the plant is placed in a peculiar position if trouble arises when the plant is put in operation.

On June 28, 1840, Zebulon and Austin Parker, of Licking County, Ohio, were granted a patent, No. 1658, for a draft tube for water wheels. This appears to have been the first use of a draft tube. In 1841, the French Jonval-Koechlin turbine was equipped with a draft tube. The first example of the use of a "d-tube" to regain velocity head was the "diffuser" of Boyden, which by 1846 was applied to most of the Boyden wheels built. This tube theoretically added 5 percent, and actually 3 percent, to the efficiency of the unit.

In 1880, James Emerson performed experiments on straight cylindrical draft tubes of different lengths. Later a short flared tube was tested.

The one basic draft-tube type, the vertical cone, has been modified in so many ways that nearly every plant has a modified tube. The vertical cone, if properly designed, is the most efficient of any type. However, modern elbow-type tubes carefully designed to recover the velocity head between the turbine and the end of the draft tube approach the efficiency of the vertical-cone type.

The elbow tube was developed to reduce the excessive vertical length required for the vertical cone. In this tube the area is increased by sloping the sides of the tube, keeping within the maximum flare of 3 to 4 deg for turbines designed for a low specific speed and 5 to 6 deg for turbines with a specific speed in the 50 range. For runners of high specific speed, such as the propeller type, and high specific-speed Francis type, the angle should be approximately 8 to 9 deg. By the use of this design, better efficiency was obtained and less draft-tube disturbance occurred.

To reduce the depth of excavation, the vertical-cone portion of the elbow tube may be bent on a radius so that the distance to the bottom of the tube approximates half the length of a straight conical tube, or less. The total length of the tube varies from 2.5 to 4.0 times the throat or discharge diameter of the turbine. As a rule the efficiency of the unit increases with the length of the tube.

Two other modifications of the vertical tube are the White hydraucone and the Moody draft tube. These differ in the method of dispersing the water with as little loss as possible.

The hydraucone originally consisted of a bell-mouth outlet with the water striking a flat floor. Half of the discharge flowed out the lower half of the tailrace cross-section, and the upstream half of the water turned up and flowed out above the bell mouth of the tube and along the top half of the tailrace cross-section. This type was later modified so that some of the difficulties in the stability of the unit were smoothed out and corrections were made in existing tubes. In one case, where a concrete cone was substituted for the water cone, the vibration of the unit was eliminated. Pitting on the under side of the unit was greatly reduced in this case.

The Moody draft tube was of the general type of the hydraucone except that a concrete or metal flared cone was centered on the vertical axis of the turbine and set on the flat draft-tube floor. The cone extended to and was connected with the center support for the turbine. This design prevented the formation of a vacuum in this central area and was a stabilizing element in the operation of the unit.

In addition to the above-mentioned types of draft tubes, the various hydraulic turbine companies have designed and tested many modifications of these designs. Some of them have been tested in flumes, either in their own, in the Holyoke, or in some other private or public flume.

The one basic draft-tube type, the

vertical cone, was originally very short, approximately one diameter in length or less. Turbine manufacturers found by experience and by model tests that the efficiency of the turbine increased with the longer tubes. However, there was a limit to this lengthening as the longer tubes caused the turbine to be set higher above tailwater to avoid deep excavation. With this increase in the length of the draft tube, a new difficulty developed—pitting due to cavitation. The best length of tube can be found by checking the specific speed of the turbine for the particular head.

The usual practice is to locate the end of the vertical draft tube one discharge diameter above the tailrace floor. Sometimes this may lead to excavation problems. To overcome this difficulty, it may be necessary to design the vertical draft tube with a bell mouth at the discharge end. If the bell mouth is properly designed, the tailrace floor can be located at approximately half the usual depth as compared with a straight discharge tube. The minimum submergence of the draft tube below the tailwater elevation should be approximately 2 ft for small units and greater for larger units.

The power and efficiency differential for the L/D ratio, plotted against a percentage differential, is given in Fig. 1, where L represents the length of the draft tube and D the diameter at the top of the tube.

Elbow-type tube

In the period 1900 to 1915, the elbow-type draft tube began to supplant the vertical-cone type. Some plants were designed with the conical tube following a circular or elliptical curve in changing the direction of flow from a vertical position to a horizontal line. Other plants with twin turbines, or possibly several pairs of turbines, were designed to discharge vertically into a curved tube leading to a horizontal tube.

The High Falls Plant on the Peshtigo River near Crivitz, Wis., is a good example of a pair of horizontal turbines discharging into an elbow draft tube. This tube was designed by the writer in 1908 and was placed in operation in October 1910. The Twin Falls Plant on the Menominee River near Iron Mountain, Mich., of similar design, was put in service in 1912.

In the *Engineering Record* for August 9, 1913, appeared an article entitled "Method for Designing Concrete Draft Tubes," by Herr R. Duds, civil engineer of Zurich, Switzerland. This was the first article that really showed the formulas and diagrams for designing elbow-type draft tubes.

Two articles by A. G. Hillberg, hydraulic engineer, appeared in the *Engineering Record* on November 13 and 20, 1915. They were entitled "Design of Turbine Draft Tubes Analyzed," Parts I and II. These articles gave a very good foundation for designing draft tubes. In the issue of November 13, 1915, the editorial on "The Draft Tube—a Neglected Feature of Hydraulic Design" called attention to vibrations in units which Mr. Hillberg contended had their origin in the draft tube. He cited a case where a draft tube designed by a consulting engineer was 5 percent more efficient than one designed by a turbine company.

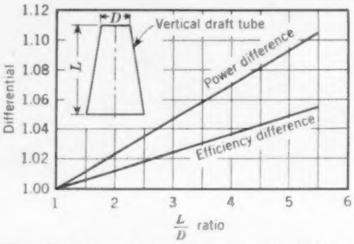


FIG. 1. Curves show power and efficiency differential for Francis and propeller-type turbines of high specific speed for various L/D ratios.

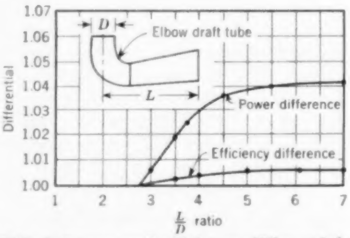


FIG. 2. Power and efficiency differentials vary according to length of horizontal leg of elbow draft tube.

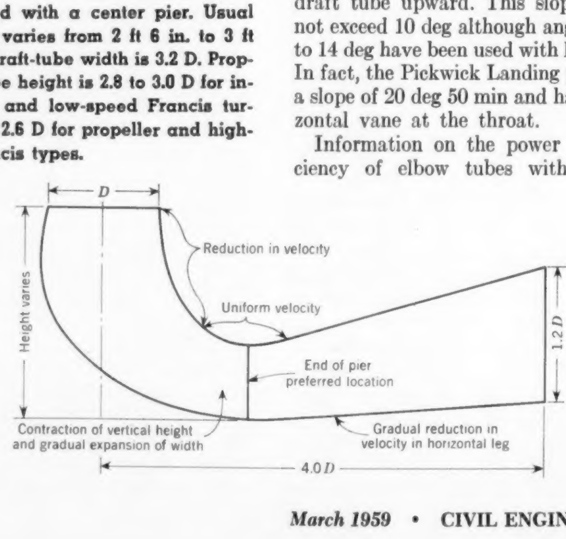
FIG. 3. Elbow draft tube is now generally equipped with a center pier. Usual pier width varies from 2 ft 6 in. to 3 ft 6 in., and draft-tube width is 3.2 D. Proper draft-tube height is 2.8 to 3.0 D for intermediate and low-speed Francis turbines, and 2.6 D for propeller and high-speed Francis types.

From 1915 to 1924, great strides were made in the design of elbow draft tubes. As experience was gained, these draft tubes were designed with a short radius at the bend and were of the spreading type. These tubes were somewhat more efficient than the heel type. Further tests by turbine manufacturers showed that if the tube had a long radius at the elbow, had the vertical height contracted and the side walls spread at the bend, so that the water would take a sheet form, its efficiency would be increased. Most draft tubes are now being designed for a reduction of velocity in the vertical section, an almost constant velocity around the bend, and a gradual decrease in velocity in the horizontal leg.

The usual and most efficient type of draft tube has dimensions that are carefully proportioned. Referring all proportions to the diameter at the top of the draft tube, the vertical height from the center line of the turbine casing to the bottom of the draft tube should be approximately 2.6 times the diameter for turbines of high specific speed such as the propeller type and the high-specific-speed Francis type. For turbines of intermediate and low specific speed, this distance becomes 2.8 to 3.0 times the diameter. The length of the horizontal tube is usually designed for 4 times the diameter. The width of the tube, which includes one pier, should be in the neighborhood of 3.2 times the diameter. If the horizontal length is 4 times the diameter, the vertical height at the discharge end will be approximately 1.2 times the diameter.

The most common practice for the elbow type is to make the horizontal leg level with the downstream end. However, on large installations the excavation problems that sometimes arise can be avoided by sloping the floor of the draft tube upward. This slope should not exceed 10 deg although angles of 12 to 14 deg have been used with little loss. In fact, the Pickwick Landing plant has a slope of 20 deg 50 min and has a horizontal vane at the throat.

Information on the power and efficiency of elbow tubes with various



lengths of horizontal leg is given in Fig. 2. Various tests have shown that the most efficient design has the pier nose located at the end of the draft-tube elbow, as shown in Fig 3. A center pier is used on larger units for structural reasons. In addition it distributes the flow more evenly at the discharge end of the tube, thus resulting in a better design. In cases where horizontal splitters have been installed in draft tubes, the tendency toward pitting and cavitation has decreased. Turbines seem to operate more smoothly with a horizontal splitter. However, the high pressure waves created in the draft tube, as a result of the rapid closing of turbine gates, have made it very difficult from a structural standpoint to design the splitter. Most types of elbow draft-tube are now being designed without a horizontal splitter.

Improper setting of draft tubes in relation to tailwater level has been common in the past. In some cases, model tests have been carried out on one design of draft tube and a different type, or a modified design, has been used in the prototype. After years of experience sufficient data have been accumulated to prove that cavitation difficulties are due largely to these causes. (See Edison Electric Institute Publication No. 52-14, 1953.) In the case of propeller or high-speed runners, it is essential, because of the angular flow at high velocities, that the prototype be developed from a test model of the turbine and draft tube proposed for the particular case. Apparently there is a critical condition of flow caused largely by the high angular velocity in propeller turbines.

One quite common error in the design and setting of draft tubes is to provide insufficient water cover at the end of the tube. This has resulted in loss of head and power by unsealing the tube with the lowering of tailwater.

Specific speed-head relation

In 1924, a subcommittee of the Hydraulic Power Committee of the National Electric Light Association submitted a report on "Pitting of Hydraulic Turbine Runners." From the data submitted at that time it was found that the specific speed of the turbine and the head were elements that could be used in a formula which could produce an experience curve for determining the possibility of pitting.

The specific speed of a turbine, N_s, is the number of revolutions per minute at which a given runner would revolve if it were so reduced in proportion that it would develop one horsepower under one foot of head.

Therefore, $N_s = \dfrac{N\sqrt{P}}{H\ 5/4}$ where

N_s = specific speed

N = revolutions per minute at full gate and head H

P = horsepower per runner

H = head in feet

The empirical equation to determine the desirable specific speed for Francis-type wheels is

$$N_s = \frac{5{,}050}{H + 35} + 19$$

A similar formula for propeller wheels is

$$N_s = \frac{7{,}000}{H + 32} + 35$$

These formulas represent conservative practice and, if installations are maintained with specific speeds and head relations below these curves, pitting will be at a minimum.

Many model tests have been made on Francis-type turbines and various sizes and shapes of draft tubes. In recent years these tests, both at home and abroad, have covered the propeller or high-speed runners. The tests show that different turbines require special treatment, depending largely on the specific speed of the particular one under consideration. For example, the propeller-type turbine with the high-velocity whirling motion of the water leaving the turbine blades requires a different treatment from that of the Francis slow-speed turbine. Dr. D. Thoma stated: "It is firmly established today that a given draft tube may be the best possible form for one runner but not for another. Consequently the runner and draft-tube should be investigated as a single system." (C. A. Mockmore, "Flow Characteristics in Elbow Draft-Tubes," ASCE *Transactions*, Vol. 103, 1930, p. 403.)

The elbow-type draft tube, properly designed for cross-sectional area and length, has proven very satisfactory for Francis-type turbines. Because of the extremely high whirling velocity of the water leaving the propeller blades of the high-speed turbine, it is questionable if a low-setting elbow-type draft tube can be proportioned satisfactorily for this type of turbine. The hydraucone and Moody or flared-type draft tubes appear to be better adapted for utilizing the "whirl component" of the water entering the draft tube. Because these draft tubes are symmetrical about the axis of the turbine, eddy loses are at a minimum and the whirl component is reduced to a reasonable amount at the exit of the tube. This again is dependent on the proper length of draft tube for the particular turbine involved.

In view of past experience, it would seem desirable to vary the flare of the elbow-type draft tube, if it is used, for the high-specific-speed propeller and Francis-Type turbine to 8 to 9 deg; for turbines with a specific speed of 50, to 5 or 6 deg; and for low-specific-speed turbines for high heads, the draft-type angle should be 3 to 4 deg. The lengths of the tubes would also vary with the use of longer tubes on high-speed turbines.

It is quite evident that the high-speed propeller type of turbine should have a sufficient length of conical draft tube before the bend. This would reduce the velocity of the water and cut down the turbulence as the water makes the right-angle turn from a vertical to a horizontal direction. The area of the tube at the bend should be widened to accommodate this tendency as the bend is accomplished. The bottom of the draft tube should follow a horizontal line or not exceed a 10-deg rise from the bend to the end of the tube.

The area at the end of the tube should be ample so that for heads under 20 ft the velocity will not exceed 3 to 3.5 fps; and for heads of 20 to 60 ft, it should not exceed 6 fps for the upper limit. For higher heads, the loss should be based on the economics of the loss of power due to head loss. The safe procedure would be to make a model of each new turbine design and the proposed draft-tube design for it and run a series of tests. The information on draft tubes for Francis turbines is quite complete so that satisfactory designs can be selected without difficulty for this type of turbine.

Manufacturer's guarantee

It is common practice with turbine manufacturers to require that any turbine guarantee as to efficiency and power be dependent on the condition that they have complete control of the draft-tube design. If the manufacturer would hold strictly to homologous design of the entire unit, turbine and draft tube, and submit tests to the plant designing engineer, much trouble would be avoided. This procedure may result in the elimination of field tests since such tests have usually shown slightly better results than tests on the model. The Moody and Cammerer formulas can be used to step up the efficiency from the model to the proposed wheel for any project. With modern methods of construction, the larger turbines can be made homologous to the model within reasonable limits.

The writer wishes to thank Mr. R. Sahle, hydraulic engineer with James Leffel and Company, who has reviewed this article and offered valuable suggestions and additions while it was in preparation.

Large boulders were displaced from foundation of east chamber of Pedro Miguel Locks. In foreground, Joseph M. Cooke, Designing Engineer, Panama Canal Company, holds rule to show how a section of the concrete floor was raised 16 in. (looking north toward intermediate gate). Official Panama Canal photograph.

Explosive buckling of floor

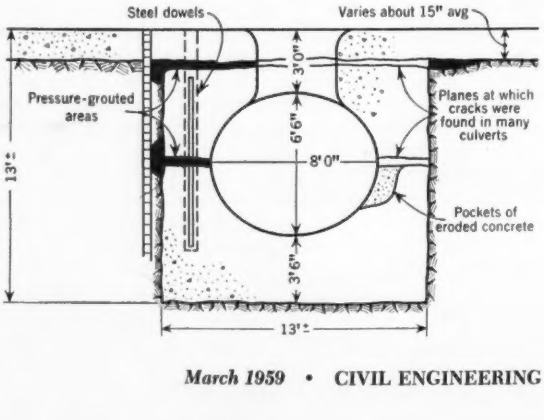
FRANK H. LERCHEN, M. ASCE, *Maintenance Engineer,*

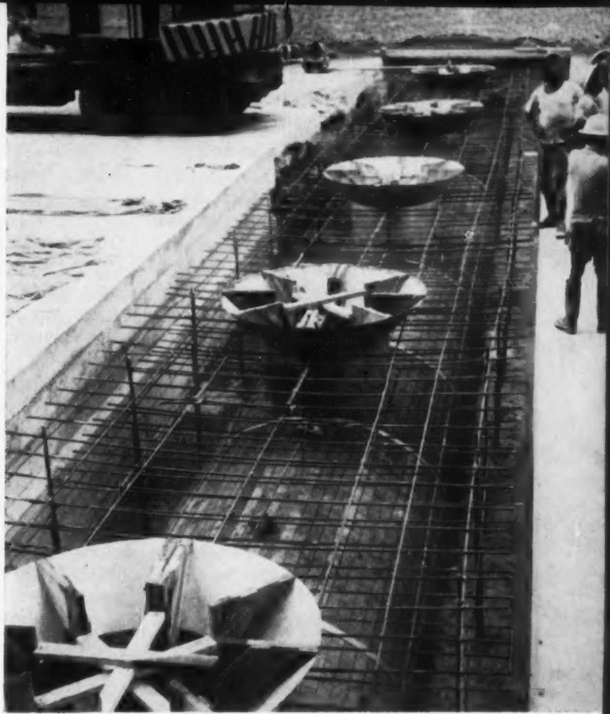
Deterioration of concrete in the filling culverts and floor of the Pedro Miguel Locks of the Panama Canal has been found and corrected, perhaps just in time to prevent serious difficulty. When the west lock chamber was unwatered for the regularly scheduled five-year overhaul it was found that the floor slab had separated from the lateral filling culvert beneath it. Through the filling holes it could be observed that the floor had been lifted and that there were cracks or openings in the construction joint between the floor slab and the top of the mass concrete of the lateral culverts.

All 14 of the transverse culverts in the west chamber were unwatered for a complete inspection. This type of inspection has not been a routine part of previous overhauls as there has been no previous indication of trouble and there are no mechanical or steel parts in these culverts. Their unwatering requires pumping and is difficult as they lie below the level of the side-wall main culvert, which serves as the drainageway for the chamber.

This inspection revealed some unsuspected weaknesses, in the form of many cracks and openings in the con-

FIG. 1. Section through a typical transverse culvert shows repair methods. Steel dowels were firmly grouted in drilled holes at most serious cracks. Pockets of eroded concrete and large cracks were gunited from inside. Opposite worst leaks, holes were core-drilled and pressure grouted.





Forms are in place for rebuilding of a lateral culvert under the lock floor. Flared tops of 48-in. ports reduce turbulence of flow in filling and emptying. Official Panama Canal photograph.

corrected in Panama lock overhaul

Panama Canal Company, Balboa Heights, Canal Zone

struction joints in the culverts. One 15-ft section was found to be so badly cracked that it had to be rebuilt. A section through the culvert, with areas where cracks were found, is shown in Fig. 1.

Although this extra work delayed the return of the west chamber to service for a few days, the conditions found brought about a decision to inspect the lateral culverts in the east chamber of the locks, on which overhaul had just been completed. Here it was discovered that one of the lateral culverts had failed entirely and some 6,000 sq ft of adjacent floor slab was badly cracked and heaved. At first sight the damage appeared to be extensive as half-ton pieces of concrete and foundation rock had been moved some 50 ft from their original locations.

Subsequent inspection revealed that by pure chance the weakest culvert had been selected for use in filling the chamber after overhaul. High velocities and pressures resulting from filling from the center-wall culvert instead of the side-wall culvert, which is customarily used, had caused the undoweled horizontal construction joint to open up, allowing water to flow under the lock floor. This built up such excessive and unanticipated pressures that the floor buckled in an explosive manner.

Immediately after the discovery, clean-up and repair work was started on an around-the-clock basis. The nature of the needed corrective measures became evident as the demolition work progressed and as it became possible to determine the circumstances under which the failure had occurred.

The chambers of the locks are filled through ports in the tops of the transverse culverts below the chamber floor. There are 14 transverse culverts in each chamber, spaced from 32 to 36 ft apart depending on their location in the chamber. Alternate culverts are connected to the main center-wall culvert through cylindrical valves individually controlled; intermediate culverts connect directly with the side-wall culvert. Thus each chamber has a side-wall culvert of its own and shares the center-wall culvert.

Each transverse culvert has an elliptical shape with a horizontal major axis of 8 ft and a vertical minor axis of 6 ft 6 in. The culvert is located slightly above the mid point of a 13-ft x 13-ft block of concrete so that the thickness of the culvert at the floor is 3 ft 6 in.

and the thickness of the sides is 2 ft 6 in., as shown in Fig. 1. Each lateral culvert has five ports of about 48-in. diameter, which pierce the chamber floor. The transverse culvert was constructed in three separate lifts. The first or "invert lift" is of variable height in the different culverts and extends generally to the spring line. The second or "arch lift" averages about 6 ft 6 in. and was designed to extend 3 ft above the crown of the elliptical culvert. The third lift, which is actually a part of the floor system, was designed to be 18 in. thick but varies in thickness from 24 in. to 6 in.

The lateral culverts and the floor system contain no reinforcement. It was obvious that there had been no cleaning out of laitance between the joints of the several pours so that the joints were not water tight.

The floor of the chamber is monolithic with the third pour of the culverts and has no specific pattern of construction joints. There is no relation between the random spacing of the vertical transverse joints in the culvert and the floor system.

In the Pedro Miguel Locks the floors of both chambers are perforated with hundreds of 4-in. weep holes. The reason for these weep holes could not be found in the records of the Panama Canal Company but tradition has it that they were formed by setting 4-ft to 6-ft lengths of 3-in. pipe into gravel-filled holes in the foundation rock in order to relieve hydrostatic pressure. Such pressure was believed to exist because there was a noticeable uplift or heaving of the floor during the two- to three-year construction period before the chamber was flooded.

Actually, instead of hydrostatic pressure, a phenomena known as "elastic rebound" probably occurred during construction. Later, after the structure was completed, an "inelastic rebound" took place. Edward Soucek, M. ASCE, who was engaged by the Panama Canal Company as a special consultant on the repair work, describes this behavior as follows:

"When a deep excavation is made, its floor rises as the load is reduced. This immediate rise is the elastic rebound. When a structure is placed in the excavation, the floor settles elastically in response to the load. Then, over a period of months or years, the floor may move slowly as the ground adjusts itself to the new loading—downward by consolidation if the structure loads exceeds the initial loading, and upward by 'inelastic' rebound when the structure load is lighter than the initial load."

This inelastic rebound has caused many small shears and open cracks both in the concrete culverts and in the foundation materials. The floor in many places at Pedro Miguel is some 4 to 6 in. higher in the center of the chamber than at the walls, and 45-deg shear cracks are evident near the ends of the filling culverts.

For the most part, the Pedro Miguel Locks are founded on the Culebra formation, which is made up primarily of fine to medium grained basaltic, triffaceous thin-bedded sandstone and siltstones with abundant carbonized plant debris and many marine and brackish-water fossils. It is relatively weak and has a maximum allowable bearing capacity of 15 tons per sq ft and a low modulus of elasticity.

Because of this low modulus of elasticity and the relatively large amount of overburden removed during the construction of the locks a rebound occurred, which undoubtedly was the primary cause of the deterioration of the culverts. Where the rebound was considerable, as in the east and west chambers, the sandstones and siltstones of the Culebra formation failed in shear in the same manner as did the upper parts of the filling culverts.

This failure in shear caused the floor of the chambers to separate from the foundation, and these openings served as passageways for the water to circulate to and from the cracks in the filling culverts as the water level in the chamber was changed in the locking operations. The washing away of weathered materials as a result of this circulation caused numerous voids along the leaky culverts and under the floor. It was also recognized that the continued existence and progressive enlargement of the voids would in turn reduce the strength of the lateral culverts and cause additional floor movements.

Repair work consisted of: (1) removing and reconstructing the top half of the one transverse culvert that failed; (2) chipping out and sealing leaks and openings in the horizontal joints in eight other culverts, by the gunite method; (3) tying together, with steel dowels of 1½-in. diameter, the top and bottom sections of seven other culverts which showed signs of opening up at the horizontal construction joints; (4) replacing the damaged concrete floor slab; and (5) low-pressure grouting of cavities under the floor and adjacent to the culverts. Ba-

Undoweled horizontal joint of this lateral filling culvert opened up during lock filling operation so that culvert had to be rebuilt. One of the 48-in.-diam ports can be seen near end of culvert. Official Panama Canal photograph.

sically, the objective was to seal off leakage from the culverts and to fill up the cavities and waterways under the slab and in the foundation rock.

To minimize delays to shipping through the canal, a maximum of three weeks was allowed for the repair work. Thus only the worst deficiencies were corrected at this time, but future overhauls will include a program of lateral culvert reinforcement, grouting, and guniting where required.

The most time-consuming part of the repair work was the removal of damaged concrete and of fractured and unsound foundation material. The Culebra formation had been softened to a depth of several feet by the percolation of water over the years, and in places it was little better than stiff mud.

The worst damage occurred at the east end of the filling culvert. Here the floor was raised and cracked on each side for about 40 ft all the way from the center of the chamber to the east wall. The culvert itself was so badly cracked that its top section had to be replaced for its full length of 100 ft.

Concrete replacement was done in three separate pours. Floor pours were first made on each side of the damaged culvert, and the third and last pour was the top half of the culvert itself. A total of 636 cu yd of 3,000-psi concrete was placed.

In replacing the floor slab over the two adjacent lateral culverts, a mat of reinforcing steel was incorporated. This mat consists of 5/8-in.-diam rounds on 18-in. centers both ways. In the top half of the culvert pour, two mats of reinforcing steel were used. These consist of 5/8-in.-diam transverse bars on 12-in. centers and 5/8-in.-diam longitudinal bars on about 24-in. centers.

In the east chamber all the lateral culverts were unwatered for inspection. Diagonal shear cracks were found in the ends of nearly all these culverts, and the floor at the center was found to be 2 in. to 6 in. higher than at the ends, following the same pattern as the chamber floor. Horizontal construction joints were found to have opened up in many of the culverts. Cracks and open joints that showed signs of leakage were chipped out and gunited.

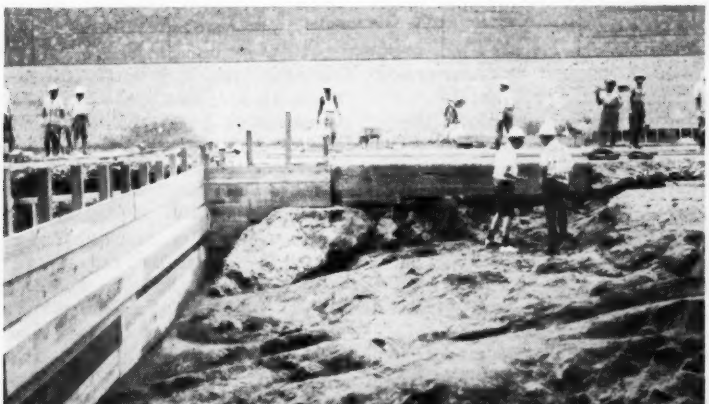
There was evidence that voids and waterways existed under the undisturbed concrete floor for about 40 ft each side of the damaged culvert. Along each side of five culverts 3-in. holes 10 ft deep and 18 ft on centers were drilled through the slab and into the foundation. Cement grout was pumped into these holes for two purposes: (1) to fill the voids under the floor, and (2) to seal the cracks and construction joints in the culverts. This grouting was very effective as evidenced by the inflow of grout into the culverts through the construction joints, and the extrusion of grout through the old weep holes.

No special problems were encountered in the repair work except that of adapting available equipment for special purposes such as the use of a road mud-jack machine for grouting at pressures of 20 to 30 psi and the use of Hough front-end loaders for transporting and placing concrete. At the beginning of the repair job, a truck crane weighing about 23 tons was lowered into the east chamber by a 250-ton floating crane operating out of the west chamber. With this exception, all materials, supplies, and equipment were handled by two 30-ton locomotive cranes operating on the east wall, at maximum boom radii. All the work was completed within 17 days, and by careful scheduling of the use of the other chamber, shipping suffered no delays.

Concurrently with the repair work, a core drilling program was carried out to explore the foundations under the walls and floor. No major deterioration was found under the lock structures, making it evident that the failure found on June 7 was a relatively minor one, confined to a small area.

Failure of this one culvert is not regarded as indicative of impending deterioration of the lock structures generally. While the failure disclosed some conditions that require correction, future operation of the locks can be made safer, in the light of the knowledge thus acquired. A repetition of this culvert failure is very unlikely to occur, and with the corrective measures that will be taken during future overhauls, the lock floors and lateral culverts should be in better condition than ever before.

Repair work was under the supervision of the Engineering and Construction Director of the Panama Canal Co., Lt. Col. Robert D. Brown, Jr., Joseph M. Cooke, M. ASCE, Designing Engineer, was in charge of engineering, and the writer, the Maintenance Engineer, served as Project Engineer in charge of construction. Major General W. E. Potter, M. ASCE, is Governor of the Canal Zone and President of the Panama Canal Co. Edward Soucek, M. ASCE, Chief, Civil Design Branch, Omaha District, Corps of Engineers, U.S.A., was engaged as a special consultant for the job.



Form at left is the side of the lateral filling culvert to be replaced. Note the variable thickness and undercut condition of the floor, here seen at about center of lock chamber. Author Lerchen, at left, explains conditions to Lt. Col. R. D. Brown. Official Panama Canal photograph.

Largest Skyway structure is Calumet River Bridge, a 1,300-ft three-span cantilever through-truss containing 5,500 tons of A-7 structural steel and 3,500 tons of high-strength steel. Center span is 650 ft long and side spans 325 ft each.

R. C. HAMM, J.M. ASCE, Field Engineer,

American Institute of Steel Construction, Inc.,

Chicago, Ill.

The last link in the magnificent modern 837-mile tollway from New York to Chicago is the fabulous $101 million Calumet Skyway Toll Bridge. This structure, 7¾ miles long, extends from the Indiana-Illinois state line into the heart of Chicago. Throughout its entire length it is elevated above the vehicle-crowded streets of Chicago's South Side. Its six 12-ft-wide lanes are designed to enable traffic to move at a speed of 60 mph. About half of the skyway is on earthfill embankment; the remainder is elevated on structural-frame bents and steel superstructures of complicated design and construction, containing 57,000 tons of structural steel.

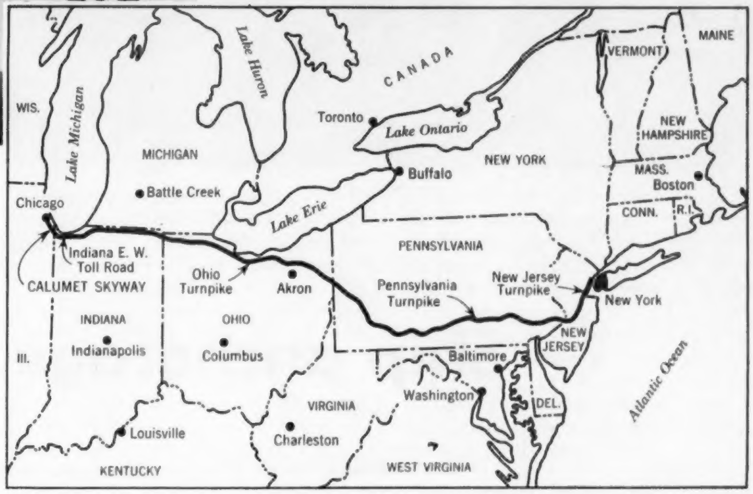
Outstanding feature of the project is the spectacular three-span cantilever bridge crossing the Calumet River at about 96th Street. This bridge is the longest and highest fixed bridge in the Chicago area. The river crossing is 650 ft, with 325-ft side spans, supported on gracefully simple steel towers. The three approach spans on the south are deck-truss sections each 178 ft long; on the north there are three similar 208-ft spans. Clearance over the river channel is 125 ft. The bridge, 2,467 ft long, contains 9,000 tons of structural steel, including 3,500 tons of high-strength low-alloy and silicon steels.

There is a three-lane, 36-ft-wide roadway in each direction and a median strip 4 ft wide. To provide the necessary width, the through trusses of the cantilever unit are 87 ft apart from center to center. A concrete deck of lightweight aggregate reduces the dead-load stresses and consequent dead-load uplift at the ends of the anchor spans. Roadway stringers, continuous over four or five panels, were spliced across the floor beams. The rivet holes for the splices were field reamed to assure continuity. Where the depth permitted, the floor beams were trussed for economy. Elsewhere composite plate-girder floor beams were utilized, except at the ends of the suspended span, where simple plate-girder construction was employed.

The three simple approach spans rest on shoes supporting two adjacent trusses at the towers and bents. These shoes transmit the loads to the individual bents, eliminating the need for expansion joints except at the ends of the three-span unit. It was impracticable to make these spans continuous because of the horizontal curvature.

For ramp of Stony Island exit spanning Pennsylvania and New York Central Railroad tracks, supports were placed where they could be fitted into the track area. Beyond the rails single column carries structure.

Toll route permits motorists to travel 837 miles from New York to downtown Chicago without encountering a traffic light. Last lap of the journey is over 7¾-mile length of the recently completed Calumet Skyway.



One unusual feature of the Skyway is the design of the Stony Island Avenue entrance and exit ramps, where it is necessary to span multiple tracks and roadways and provide vertical railroad clearances of 22 and 23 ft. The final plan provides for long-span deck girders framing into "hammer-head" single-column supports, with braced twin-column steel piers to stabilize the structure.

The main girders range in length from 106 to 211 ft, and all are 8 ft deep. At the ends of each ramp there are shorter spans made up of wide-flange steel beams. The "hammer-head" columns and the twin-column piers are generally supported on cylindrical concrete caissons excavated to rock.

Hammer-head column

Of particular interest is the "hammer-head" column in the median strip on Stony Island Avenue just north of South Chicago and 79th Street, shown in an accompanying photo. This single column is 49 ft high from its base on the caisson to the under side of the cross girder. A part of the steel column extends into the ground and is concrete encased so that the base will be at a low enough elevation for the future expressway underpass of Stony Island Avenue.

Near the Indiana state line, unsymmetrical welded rigid-frame bents were used to clear the three north-bound lanes of Indianapolis Avenue. The welding is designed to meet the specifications of the American Association of State Highway Officials and those of the American Welding Society for Welded Bridges. A-7 steel was used for beams and non-welded parts and A-242 high-strength steel for the welded sections.

All tension butt-welds and most of the compression butt-welds were examined by radiographs to insure good workmanship at all critical points. Fillet welds were made by the submerged-arc process and were not examined radiographically. Diagonal stiffeners were placed on the webs of the knees to prevent buckling at points of high compressive stress.

Field splices, made with high-strength bolts, were so arranged that fabricated pieces could be shipped by rail. In general, the beam part of the frame was fabricated in one piece and the legs were field connected, either at the beam or at some point on the column leg.

The bents were made of built-up plates. Some bents have wide-flange beam caps and legs consisting of plates and channels or plates and wide-flange beams. All bents, except single-leg bents, were designed as though pinned at the base although actual pins were not provided. Single-leg bents were assumed to be fixed at the base and were bolted to the concrete foundation.

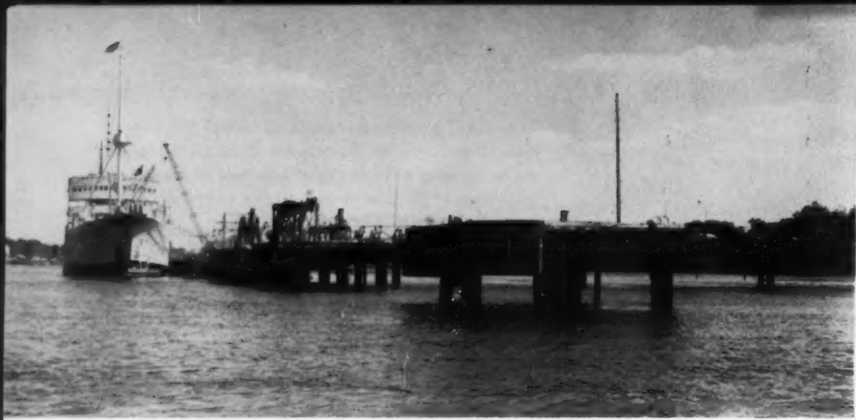
The bents are supported by concrete pedestals, which in turn are supported on concrete piles driven to hardpan. Bents subjected to large lateral loads have horizontal ties below the ground surface, while other piers depend on batter piles to resist such forces.

At about the midpoint of the Skyway is the toll plaza consisting of two identical staggered collection stations each 188 ft wide and serving 11 lanes of traffic in one direction. Unusual design features of the plaza include six "hammer-head" canopies for each station, which carry the roof over the toll-collection booths. The head of the "hammer" is 30 ft 6 in. long and is made up of ½-in. welded plate stiffened with plates every 3 ft 4 in. The canopy column is 2 ft wide and 3 ft long at its base and is anchor bolted into concrete.

Many groups participated

The entire project was constructed by the Department of Public Works, City of Chicago, under George L. Dement, Commissioner. DeLeuw Cather and Company were the coordinating engineers. The consulting engineers, who did the detail designing and supervision of construction, were Freidman, Kornacker Engineering Company, Inc., Alfred Benesch and Associates, H. W. Lockner & Company, Consoer, Townsend & Associates, A. J. Boynton & Company, J. E. Greiner Company, and Hazelet & Erdal, all of Chicago.

Structural steel contractors for the Skyway were the American Bridge Division, U. S. Steel Corporation, for the Calumet River Bridge and Stony Island Avenue ramps; the Bethlehem Steel Company for the state-line connections; and the Egger Iron Company for the toll-booth canopies. Other steel work was fabricated by the Allied Structural Steel Companies and the Mount Vernon Bridge Company.



Cable-laying ship is tied at anchored caisson tripod pier, built on rock without dependable overburden.

Ship anchorage on rock

J. H. THORNLEY, M. ASCE, President, Western Foundation Corporation, New York, N. Y.

Detail of pier. Tops of the three anchored caissons of the tripod are encased in concrete-filled steel shells of 6-ft 3-in. diameter.

Land equipment on a scow was used to cut sockets for vertical Drilled-In caissons to widen the approach to the pier. At right, note the rollers for cable travel from plant to ship.

Eight "strong-points," each consisting of an anchored caisson tripod, provide an economical offshore anchorage at Newington, N. H., for the Simplex Wire & Cable Co.

The anchored caisson tripod is new as a foundation element—in its structure, its applications and its capacity. The name, which originated by chance rather than choice, is misleading in the extreme. The efficiency and operation of the standard tripod in handling nearly vertical loads is well known. The primary purpose of the anchored tripod is to resist horizontal loads where little or no vertical load exists.

Resistance to horizontal thrust

The resistance of an anchored tripod to horizontal thrust has the peculiar characteristic of being virtually unaffected by the variation in elevation of the point of horizontal load applied at its apex. This is true for any height above the point of ultimate support, providing only that the axial load in any one of its three members does not exceed the axial load capacity of that member. For example a tripod of 36-in.-dia caissons resisting a horizontal force will not require reduction of working stresses or addition of intermediate bracing up to a depth of 200 ft. With comparatively light bracing the depth might easily be 400 ft or more. No bending load enters into the calculation of the resistance value.

The anchored tripod has another characteristic of great value in dealing with horizontal loads variable in amount and direction such as ship impact, wind, currents or drifting ice. Virtually the same horizontal resistance can be developed by the anchored tripod around the full 360 deg of the compass. See Fig. 1. It is these principles that have been used at the Simplex plant in New Hampshire.

The solution developed for that project is an anchored tripod of one vertical and two battered 30-in.-dia Drilled-In caissons for each of the eight strong-points. These caissons are formed by lowering a pipe of ½-in. wall thickness and 30-in. diameter to the rock, starting a hole with a churn drill, driving the pipe to a firm seat in the rock and then drilling to provide a socket deep within the bedrock. The depth of the socket depends upon the load to be transmitted and the quality of the rock. A steel core is installed, extending from the bottom of the socket to the apex of the tripod and encased in concrete. The details of this installation are seen in Figs. 3, 4 and 5.

It will be noted that: (1) the vertical caisson has a 14-in. WF 426-lb core; (2) the other caissons, at a 45-deg angle, are battered 1 on 6 and have a lighter core; and (3) the supplemental support for the deck is developed by vertical Drilled-In caissons of 24-in. diameter with light cores. The caisson on the pier face is made vertical to avoid interference with ships alongside. For an installation requiring greater horizontal resistance, the three caissons might all be similarly battered.

New combination of units

To implement the design required units probably never before used together for skeleton anchorage structures, including:

1. Drilled-In vertical caissons capable of developing axial compressive load capacities up to 1,570 tons each. (This was the maximum capacity needed for the Simplex job but it could have been 50 percent higher if required.) These same caissons were designed to develop tensile strength up to 1,250 tons and in larger diameters could have been constructed to develop twice that load.
2. Battered caissons capable of developing resistances similar to those of the vertical caissons either in axial compression or tension.
3. A method of framing the strong-points to assure that under all conditions and under all loads at least two of the caissons will be axially loaded.

In combination, (1) (2) and (3) constitute an anchored Drilled-In caisson tripod.

The site for the pier is definitely unfavorable for any standard type of anchorage. Hard rock with an irregular surface, under 6 to 10 ft of loose silt, slopes outward from the exposed shore in an area subject to very heavy tidal currents and high winds. A height of nearly 60 ft from dependable ground to mooring level required the transfer of large shear loads and the resisting of considerable moments in rock. Conventional means of construction of anchorages in such a location seemed prohibitively expensive.

Poor toe-hold on rock

Rock-filled cribs could have been used to carry the deck and take the horizontal thrust. But there was little chance for a toe-hold in the outward sloping rock; a lateral dimension of perhaps 70 ft would have been required at each of the eight anchorage points.

Preassembled steel towers with three or more cross-braced columns might have been lowered to rock. But it would have been difficult to build such a tower to fit the rock configuration. Shear resistance at the rock surface would also have to be provided and this force transferred by strong cross bracing of the towers, to counteract the horizontal forces of wind, waves and the surge of ships riding out a storm at the dock.

Steel sheetpile cofferdams filled with tremie concrete might have been used but, since weight would have had to be provided to prevent overturning, very

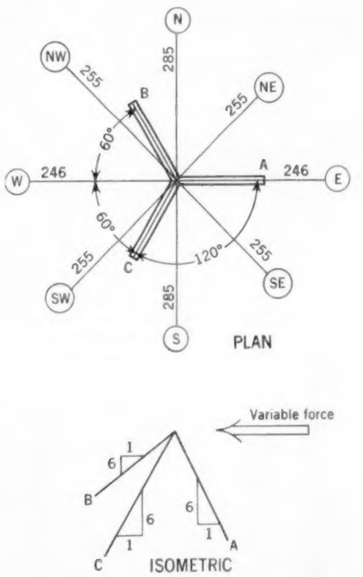


FIG. 1. The anchored tripod with legs equally spaced has an almost uniform reaction to a horizontal force from any direction applied at its apex. The resisting forces shown are for a 1,000-ton axial capacity in each leg.

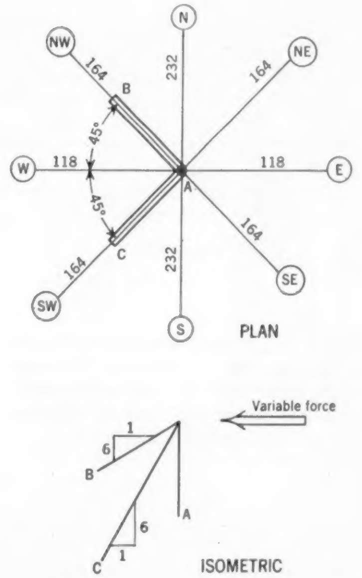


FIG. 2. One vertical leg with anchor arms at an angle of 90 deg has a variable reaction, shown for a 1,000-ton axial capacity. On the Simplex project a vertical member of larger capacity made the pattern more efficient.

large units would have been required. Caissons installed under air pressure were a possibility for each of the needed strong-points but such caisson work requires a great deal of very costly labor.

The basic reason for the high cost of conventional anchorages is the need for vertical dead-load to assist in developing stability against horizontal live-loads. The Drilled-In caisson strong-point design utilizes to an unlimited degree the weight of the rock crust of the earth.

A number of skeleton anchorages have been built around the world but almost without exception where deep overburden above rock was available. The essential overburden was not available at the site of the Simplex anchorage.

Problem not unique

The design of the anchorage at the Simplex plant is unique and therefore is worth study. If the problem, like the solution, was also "unique" it would be only of passing interest. However, in very many areas along coastlines low-cost offshore anchorages could be used to advantage but foundation conditions have in the past precluded their construction. The Simplex design would be effective from both an engineering and an economic standpoint. New deep-draft ships make this even more important as existing harbors cannot accommodate many of the vessels now being put into service.

The anchored-tripod design can be used at very moderate cost. This design requires no cofferdams either permanent or temporary. It can be built with readily available equipment.

The Simplex job was built in two stages. In the first a 100-ft by 30-ft dock section was constructed 250 ft offshore. This consisted of two of the tripod-type strong-points for mooring and six simple vertical members for the supplemental support of a concrete deck. Also in the first stage, five additional strong-points provided mooring for the ships. First access to the pier was over a lightweight structure supported on single Drilled-In caissons spaced 55 ft on centers. The access pier carried roller racks to permit the cable to be drawn out to the ships and was wide enough for light truck access. Ships at this anchorage rode out New England's most recent hurricane. The strong-points have functioned perfectly as anchorage for ships since 1954.

Additional pier facilities—recently completed—include an extension of the pier proper, a mooring platform around one of the isolated strong-points, and widened access to permit truck delivery of ship stores directly alongside. The same plan of tripod strong-points and vertical Drilled-In caissons used on the first section was adopted for the section just completed. Now two ships at a time can load directly from the manufacturing lines while a third ship remains at anchor for servicing. The cable comes out in a strand over the dock and into the ship in long lengths.

Construction was largely done with equipment available locally. Scows were rented; on one of them a Keystone drill was mounted for cutting the sockets into the rock. Another scow carried a crawler crane that was used for handling pipe, setting the heavy cores and placing concrete. Spuds held the drill barge in position but the overburden was inadequate to hold it in rough weather.

General planning for the first section of the Simplex project was handled by Charles T. Main, Inc., of Boston. Details of the anchorages were worked out by the Drilled-In Caisson Associates. This anchored caisson tripod is patented and further patents are pending. The initial installation was made by Drilled-In Caisson Corporation, a subsidiary of Western Foundation Corp., and by Spencer White & Prentis, Inc. The recent work was done by the latter two firms as joint-venturers. Everett Morss, President of the Simplex Wire & Cable Co., and J. F. Rowe, Marine Superintendent of that company, outlined the general requirements for the pier and anchorage and worked out many of the details of construction.

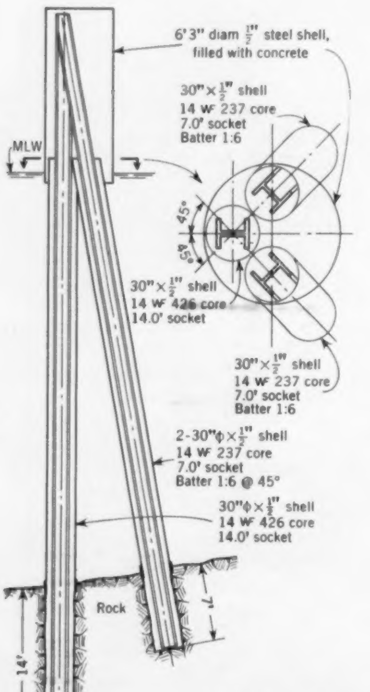


FIG. 3. Section through typical "strong-point" used for the Simplex project.

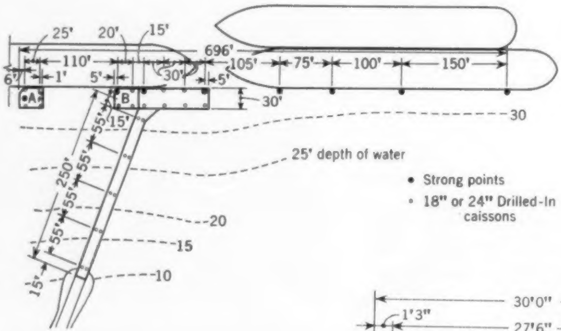


FIG. 4. Plan of marine facilities at plant of Simplex Wire & Cable Co. Platforms marked "A" and "B" are recent additions but the strong-point at "A" was part of the original project.

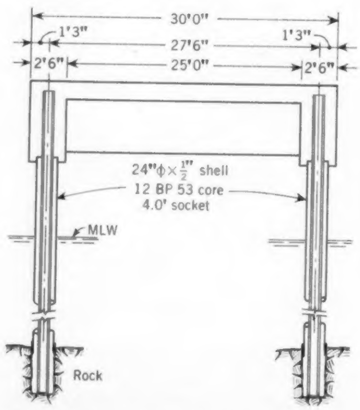


FIG. 5. Section through intermediate pier between strong-points.

Improved culvert performance through design and research studies

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Improving culvert performance by reducing energy losses at the entrance, in the barrel, and at the outlet, is the aim of engineers conducting design and research studies on culverts. Such reductions make it possible not only to increase culvert capacity but also to decrease erosion downstream from the culvert. Potential savings in construction cost, it is expected, will be enormously more than the outlay for the engineering and research required to attain them.

The purpose of the ordinary highway culvert is to convey water from one location to another under the influence of gravity. Culvert capacity might then be defined as the maximum discharge a culvert can yield under a given head differential. Such a definition tacitly recognizes that the energy corresponding to the head differential is used up in getting the flow from one end of the culvert to the other. It is very important to understand how this energy is used up.

In the ordinary box culvert with a squarish entrance and exit the total friction loss coefficient, C_L, can be expressed as a multiplier of the velocity head of flow in the barrel, as follows:

	Coefficient of
Entrance loss	0.5
Barrel friction	0.5
Exit loss	1.0
Total loss, or C_L	2.0

Now if we let H be the overall drop in head between the flow upstream and the flow downstream from the culvert, and V the average velocity in the barrel, we can write

$$H = C_L \frac{V^2}{2g}$$

or, for the case of the ordinary box culvert just analyzed,

$$H = 2 \frac{V^2}{2g}$$

Solving this equation for V we get $V = \sqrt{gH}$. Now suppose it were possible to reduce the value of the loss coefficient C_L from 2.0 to 0.5. Then $V = 2\sqrt{gH}$. Thus the velocity in the culvert would be doubled, and its carrying capacity would also be doubled.

It thus appears very desirable to reduce the loss coefficient. Let us examine the matter further to see how this might be done. With regard to the entrance, the mechanics of energy loss involve the formation of eddies downstream from abrupt corners of the structure. If the entrance design provides for a gradual transition from the channel upstream to the barrel of the culvert, then these eddies are eliminated. The loss coefficient drops from 0.5 to 0.1 or even less. Research to effect this elimination of large-scale turbulence at culvert entrances is currently being conducted by the Bureau of Public Roads and cooperating agencies. Devices to control entrainment of air at culvert entrances are also being tested.

The friction loss can be reduced by the use of very smooth walls, such as concrete surfaces formed against treated plywood or smooth steel. The reduction in the loss coefficient corresponding to a change from very rough to very smooth concrete is about 40 percent. Let us assume a reduction in the loss coefficient from 0.5 to 0.4 by virtue of using very smooth walls in the barrel.

As for the exit loss, it is here that the greatest saving in energy can be made, and it is this saving with which this paper is primarily concerned. Furthermore, this saving results in a decrease in the energy available for eroding the natural channel downstream from the culvert. Let us assume that the exit loss coefficient can be reduced from 1.0 to 0.2, and observe in the following example how this can be done through the use of an adverse grade near the exit, which results in a conversion of kinetic energy to potential energy of elevation.

Consider a typical culvert of 48-in. diameter with abrupt entrance and exit

headwalls on a 0.5 percent grade with an overall length of 200 ft and an unsubmerged outlet.

The velocity corresponding to the slope and diameter given is 8 fps, while the discharge flowing full would be 100 cfs. The water surface at the inlet would be 1.5 velocity heads or 1.50 ft above the top of the pipe. Thus the total available head differential becomes 1.50 ft plus a friction drop of 1.0, a total of 2.5 ft.

Now let us see how we might use a 36-in. pipe to carry exactly the same discharge. The velocity would be 14.2 fps, the velocity head 3.12 ft, and the friction slope 1.08 percent. Assuming 0.1 velocity-head entrance loss and 0.2 velocity-head exit loss, the total overall drop becomes 2.16 ft plus 0.94 ft or 3.10 ft. This is only 0.60 ft more than the drop with the 48-in. pipe, which is more than made up by the decrease in diameter if the outlet is not submerged.

Figs. 1 and 2 contrast the two designs. Note that the central part of the culvert is omitted between break lines. A cost comparison follows:

Conventional Design, 48-in. dia.

Barrel	200 ft @	$18 =	$3,600
Entrance	5 cu yd @	100 =	500
Exit	5 cu yd @	100 =	500
Total			$4,600

Depressed Design 36-in. dia.

Barrel	183 ft	@ $ 11 =	$2,013
Entrance	15 cu yd @	125 =	1,875
Exit	4 cu yd @	125 =	500
Total			$4,388

Thus the total cost is not much different, allowing for the 25 percent increase in concrete unit cost due to the more difficult forming of the entrance and exit of the depressed design. However, since the design with a 3-ft diameter has less exit energy, it would also result in decreased erosion problems downstream. Thus it can be seen that the depressed design is attractive from two points of view: (1) low original cost and (2) absence of erosion downstream. The significance of these attractions would increase of course with the size of the culvert.

In Fig. 3, (*a*), (*b*) and (*c*) three designs of equal capacity are contrasted. Their estimated construction costs are $460,000, $280,000, and $260,000 respectively. The large savings made possible by the two depressed designs, which also eliminate the downstream erosion problem, indicates the urgency of a research and design study program to develop useful standards for it. Table I outlines a program of development designed to effect savings in culvert construction costs of many hundreds of millions of dollars in the proposed 47,000-mile interstate system. The key problems to be overcome are of two types: (1) Education of designers in the application of well-known hydraulic principles, and (2) development of a few additional empirical relationships through engineering and research.

Since the program outlined in Table I is but one of a series of hydraulic and structural design studies of culverts, both completed and in process, it is essential that a considerable amount of library and correspondence research be undertaken preparatory to it. For example, current research on culvert entrance designs at the Bureau of Standards and elsewhere should not be duplicated. However, it is likely that the depressed designs will require entrance geometry quite different from that being currently studied. Therefore, provision is made in the proposed program for all elements of depressed culvert design.

Although they do not affect the design of efficient semi-depressed culverts, sedimentation problems are the key ones to be overcome in fully depressed-culvert designs. One design solution is to use a low-flow bypass set at normal grade along one side of the main culvert. Not only would this provide a systematic and positive means for diversion during construction, but it would also eliminate the continuous deposition of sediment that

TABLE I. Research program proposed to effect savings in culvert construction costs

I. Hydraulic design, laboratory and field studies
   A. Energy-loss problems
      1. Entrance designs
      2. Exit designs
   B. Sedimentation problems
      1. Studies of rate of deposition
      2. Studies of rate of scour
II. Structural design and construction cost studies
   A. Structural design
      1. Entrance and exit structures
      2. Barrel design
   B. Construction cost studies
      1. Entrance and exit structures
      2. Barrel structure
III. Standard design and detail drawings
   A. Pipe culverts
      1. Entrance structure
      2. Exit structure
   B. Poured-in-place culverts
      1. Entrance structure
      2. Exit structure
      3. Barrel structure

might otherwise occur during low flow. The main culvert would be reserved for peak discharges, for which it would be very efficient. A relatively small gravity drain line would provide adequate drainage of the low part of the culvert so that it would normally be completely dry and available for inspection. Should it be desirable to use the culvert as a cattle pass during dry periods, the slopes at the ends could be made gradual enough so that stock could ascend and descend.

In the case of small culverts where construction diversion would be unnecessary and where the added cost of the bypass line would be prohibitive, the culvert would be allowed to fill up with sediment to an equilibrium depth, and would be rapidly scoured out during high flows.

Design and laboratory studies, plus field verification, would be used to develop the entrance and exit shapes that would produce this type of behavior. In general, it would be possible to proportion the entrance structure so that barrel velocities would always be greater than approach velocities. Thus deposi-

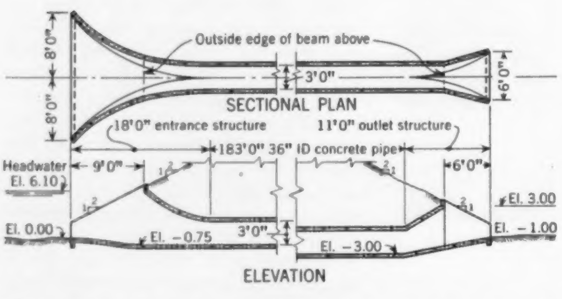


FIG. 1. Culvert pipe of conventional design has a 48-in. diameter and unsubmerged outlet. Discharge, flowing full, is 100 cfs. Compare this design with the one at right.

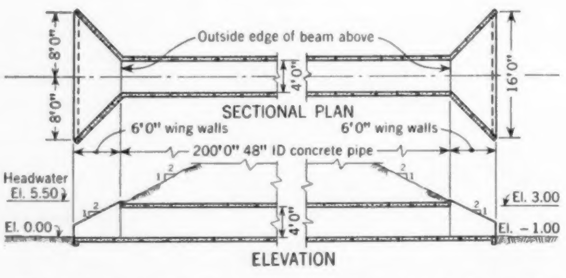


FIG. 2. Culvert pipe of depressed design, which also carries a discharge of 100 cfs, has a 36-in. diameter. This pipe has less exit energy than the design in Fig. 1 and results in a minimum of downstream erosion problems.

tion would always occur upstream and not in the barrel. Field verification of such assumptions would be achieved by careful observation and testing of existing culverts modified to become the equivalent of depressed culverts through construction of appropriate entrance and exit structures.

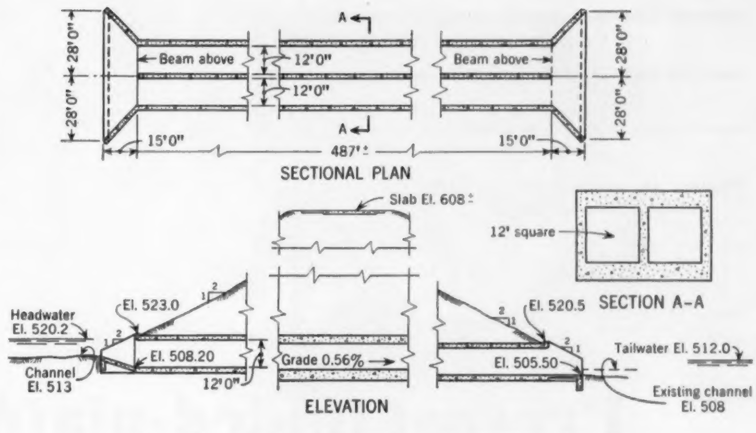
The studies of structural design and construction cost would develop the most practical shapes and proportions of entrance and exit structures to fulfill hydraulic requirements. Similar considerations would evolve the most economical barrel designs. Provision would be made in the study for varying the unit cost of concrete, forms, steel, and standard pipe to account for varying price conditions.

The standard design and detail drawings for depressed culvert design should be carried to the point where they will be as convenient to use as those currently being employed. This would involve, for pipe culverts, the selection of a series of "standard" arrangements to fit the requirements of various discharges, heads, lengths, and unit costs. For non-pipe culverts, the standard would take the form of a comprehensive computer program giving all dimensions and details (including bar bending data) for every conceivable combination of discharge, head differential, length, height of fill, velocity of approach, sediment size, and unit cost.

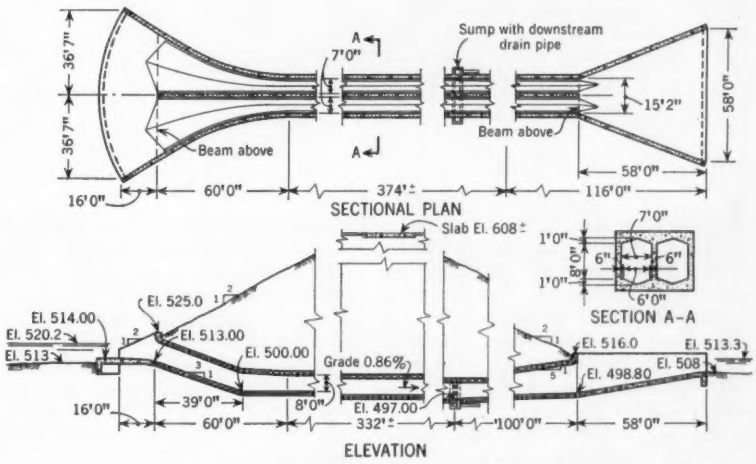
Conclusion

The fundamental concepts of accelerating flow through, and of recovering kinetic energy at the end of, a closed conduit or open channel is not new. They have often been applied in the design of inverted siphons and diversion tunnels. One of the latter (Box Canyon Project, Pend Oreille River, Washington) was designed by the writer, and the model was studied at the St. Anthony Falls Laboratory. The model demonstrated the transition from supercritical to subcritical flow in an open channel without a jump. About 8 ft of velocity head was recovered at the design discharge.

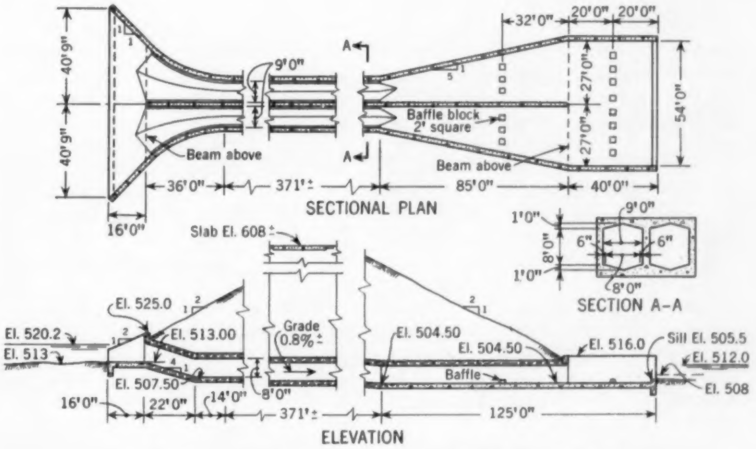
The application of these ideas to culvert design, the writer believes, has always been blocked by lack of competent personnel and by the assumption that a depressed culvert will sooner or later be made inoperative by accumulated sediment. This paper advances the opinion that such failure can be avoided by proper design and advocates a prompt research and design study to determine the extent to which efficient design should be applied. The potential construction-cost savings are enormous, at least a thousand times the cost of the engineering and research required to attain them.



(a) This culvert cost $460,000 or about $900 per lin ft.



(b) This culvert cost $280,000 or about $510 per lin ft.



(c) This culvert cost $260,000 or about $450 per lin ft.

FIG. 3. Three culvert designs of equal capacity are contrasted.

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Precast folded-plate roof for a

Folded-plate slabs, precast on their companion pieces, span more than 75 ft to roof a paint manufacturing plant on the Cuban Central Highway 24 miles west of Havana. The new plant for the Du Pont Inter-American Chemical Company is on a sloping site in an area where several industrial plants have recently started production.

The project consists of twelve buildings laid out in the expectation that later expansion will double the present capacity. The buildings were oriented according to the natural terrain, taking advantage of gravity to conduct the finished paint products to their final containers. The main manufacturing building is divided into three sections—for raw materials, processing and storage. It is a one-story structure, with two different floor levels separated by a retaining wall. This split-level solution fits the site and expedites the flow of materials. The building is a reinforced concrete structure with folded-plate roof slabs.

In keeping with the architectural treatment of the adjacent plant, the administration building and the laborers' service buildings (lunch room and locker room), at the west end of the site, were designed as gabled bents with oppositely pitched sun-shading cantilevers on each side.

A series of five sheds for auxiliary maintenance and processing of raw materials face the high end of the main manufacturing building, separated by a concrete paved area 94 ft wide. The bearing walls of these sheds, which are weather protected by flat-slab roofs, were treated with an exposed weaving brick texture, forming a trapezoidal geometric figure similar in form to the folded-plate slab of the main building. The remaining buildings blend with the unified scheme to emphasize the main architectural feature of the entire project, which is the paint manufacturing building.

Gable-bent buildings

The pitched bents of the administration building, locker room and lunch room, were precast at the site. Since the uniform thickness of the bent is only 10 in., the inclined roof slabs between bents were formed into broken planes as shown. Where the design moments were positive, the slab was placed flush with the upper section of the bent. Where the design moments were negative, the slab was placed at the level of the bent soffit so that the slab and the bent beam could act as T-sections throughout the stressed area of the structure.

Within the tapered column sections of the bent, 4-in. plastic tubes were placed to act as down spouts for roof drainage. Spacing of the bents was 13 ft 2 in. on centers. The roof slab has a uniform thickness of 4 in. Concrete is of 3,000-psi quality with steel reinforcement of structural grade.

The main manufacturing building is a one-story reinforced concrete structure with two floor levels, the upper level about 12 ft higher than the lower one. The building, 343 ft long, is roofed with a folded-plate slab spanning 75 ft 7 in. and cantilevered as a canopy. The roof has a clear height of 14 ft 9 in. and is supported by precast lateral 12-in. x 24-in. beams continuous over 12-in. x 28-in. columns spaced 18 ft on centers.

Soft clay in the area limited the allowable soil bearing to 2,500 psf. To prevent excessive differential settlement of the structure, the 12-in. x 43-in. grade beams along the sides of the building are designed to transfer 15 percent of the column load to the two adjacent footings and deflect not more than ⅝ in. Footings, pedestals, and retaining walls were cast in place. The rest of the structural components of this building were precast at the site.

Two important factors were to be observed in the design of this building. The roof had to span the entire floor area without intermediate columns, to allow complete freedom of movement and any desired arrangement of equipment in the building. Fire hazards had to be reduced to a minimum.

Since no restrictions were placed on the type of structure to be used, several types of steel and reinforced concrete buildings were considered in order to arrive at the most economical solution. Factors that led to adoption of reinforced concrete construction were increased fire protection and increased resistance against atmospheric corrosion. A steel structure would require constant maintenance, for in Cuba the

paint plant

Three slabs were cast one over another. A special curing compound also served as a film to prevent the slabs from sticking together. Note the plastic tubing protecting the tensors for an end slab.

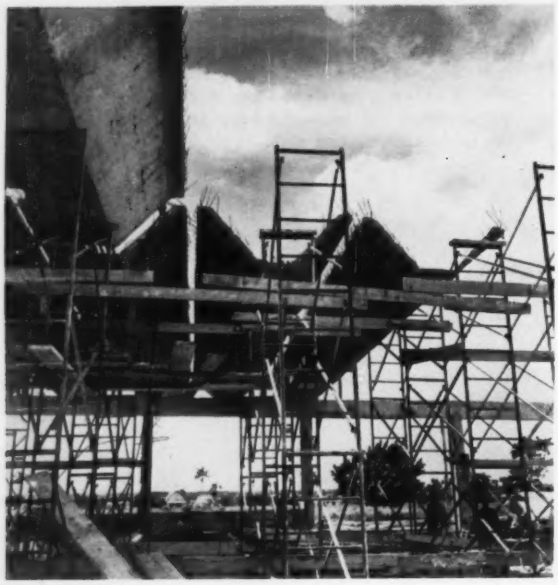
humidity, salt content and temperature of the air are high, aggravated by abundant rainfall. The availability of construction material at lower cost in the local market also contributed to the selection of a reinforced concrete structure.

Within the field of reinforced concrete structures the folded-plate slab type was found to be the most suitable solution since the floor area was to be left free from intermediate columns. This plan was economically favorable as regards construction materials and also offered better possibilities for lowering the labor cost. This type of structure can easily be adapted to prefabrication, which reduces formwork and scaffolding to a minimum. The conventional gabled or haunched-bent solutions and other types of beam-and-girder design require greater quantities of concrete, reinforcing steel, formwork, and labor.

Secondary considerations that contributed to the final selection of the folded-plate roof design were:

1. Improvement in the esthetic character of the structure.
2. Reduction in the cost of sun shading by cantilevering the roof slab.
3. Two-fold improvement in acoustical conditions because there is a larger surface area for the dissipation of sound, and also because the alternate and oppositely inclined planes break up the sound waves.
4. Reduction of heat transmitted to the interior, since the direct rays of the sun strike only one of the two inclined

Precast folded-plate slab is being lifted to top of the two-level zone of the manufacturing building, where columns are 26 ft high.



Du Pont paint plant consists of three-gabled bent buildings to left followed by five process and maintenance sheds, drum storage in background, and the main manufacturing building.

Pipe scaffolds supporting the half slabs were used as platforms for butt welding the main reinforcement.

planes of the folded-plate slab at a time.

5. Reduction in the cost of impermeabilization, as the rain water is rapidly conducted away from the slanted planes.

6. Elimination of undesirable hairline cracks by allowing free expansion and contraction caused by temperature changes.

Folded-plate design

This folded-plate roof was designed according to an ultimate strength method, which is similar to the approved tentative ACI-57 ultimate strength method. The folded-plate element was calculated on the basis of 3,000-psi concrete and the use of structural-grade steel reinforcement. A coarse aggregate of 5/8-in. maximum size was used to facilitate the placing of concrete.

The minimum factors of safety used for dead and live loads were 1.5 and 2.0 respectively, which offered an overall factor of safety in flexure of 1.66 considering the working stress of the steel reinforcement to be 19,900 psi at full load. The live load considered in the design of the slab is 30 psf, which includes hurricane forces at the low level of the roof.

A cross section of the folded-plate slab is shown in Fig. 1. The thickness of the inclined sections is 3 1/8 in. while the slab thickness in the horizontal plane is 4 3/4 in. The increased thickness in the horizontal plane resulted from the method chosen of pouring one slab over the other in the precasting process. It also was favorable in resisting the compression stresses of the upper zone, and in providing concrete coverage for the main reinforcement. The angle of inclination of 48.3 deg was determined by the column spacing, by which two slab units were fitted into each bay, and by the total depth of the slab, which is 3 ft 3 3/8 in.

The free span of the folded-plate slab is 75 ft 7 in., and its total length is 91 ft 3 in. The eaves extend in cantilever 7 ft 10 in. out from the sides of the building, with the ends of the cantilevered slab cut off at a 45-deg angle. For drainage purposes the roof slab was given a 2-percent pitch from the center toward both sides of the building. In addition to this pitch, the slab was raised to form a flat parabolic curve to meet elastic and plastic deflections. Design calculations showed that the ordinates of the deflection curve were 3 1/8 in. at the centerline and 2 3/8 in. at the quarter points of the free span.

The actual elastic deflection of the slab, checked immediately after the scaffolding was removed, was 1 3/8 in., or slightly less than half of the assumed plastic plus the elastic deflection. No further appreciable deflection drop after the initial elastic deformation was observed in the slab when it was checked one month later. However, the plastic effect will bring the total actual deflection near to the computed values.

Prefabrication procedure

Casting the folded-plate roof in place was considered but quickly discarded. This method would have required a large amount of formwork at consider-

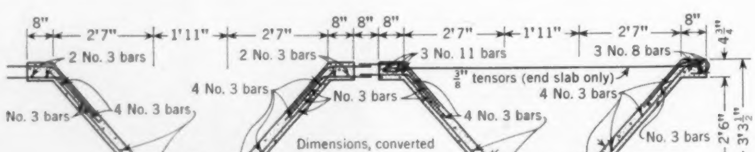


FIG. 1. Transverse section of precast folded slab used to span 75 ft 7 in. and cantilever an additional 7 ft 10 in. at each side.

able height as well as the placing of numerous heavy 80-ft No. 11 reinforcing bars at a height of 15 ft, requiring a crane almost full time.

Considerable study was given to a suitable method of prefabrication. Calculations showed that one full unit of this folded-plate slab would weigh about 22 tons and would require heavy cranes with at least an 80-ft boom to place it in the two-level section of the building. Furthermore, the slab would have to be provided with special bracing for such handling.

The solution adopted by the builders as the most favorable was to precast a half length of one folded slab. The weight was thus reduced to about 11 tons; handling was easier; compression stresses in the inclined planes were reduced to one-fourth what they would have been for an entire slab; and the rigidity of the element was increased while the danger of buckling was reduced.

Plywood forms were prepared for two half-elements to begin with. Each form was so arranged that the part supporting the inclined sections of the slab could be reused 48 hours after casting, leaving the form under only the 25-in. horizontal strip. The folded-plate slab was so designed that a previously poured slab could serve as a mold for succeeding slabs. Six slabs were allowed to accumulate over one another. Further piling would have exceeded the bearing capacity of the soil, inducing undesirable settlement of the group of slabs, and would have increased the instability of the slab stack to such a point that over-turning forces would reach dangerous levels.

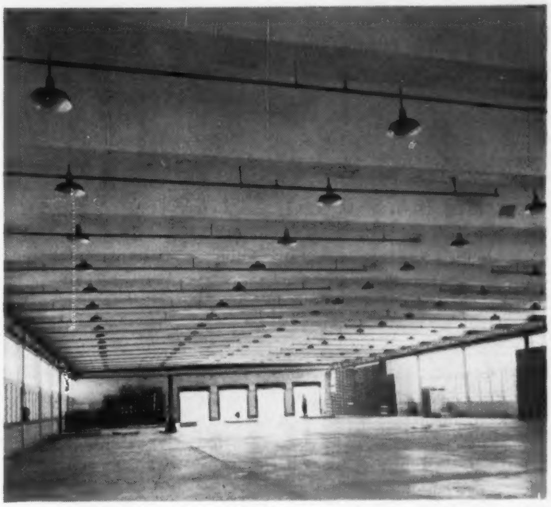
Twenty-four hours of curing time was allowed to elapse before the next slab was poured. Removal of a slab from its mold was not allowed until after a five-day curing period, to assure development of sufficient bonding properties and resistance to shear in the zones where the slab was to be lifted.

Several of the half-slabs were distributed within the building area to serve as molds for the rest of the 82 slabs needed. This method allowed a geometric progression in the number of folded-plate slabs poured in one day. The average number poured in one day was six.

Twenty working days were required for pouring and thirty days for final placing of slabs and removal of scaffolding. Each of the 46-ft-long slabs was provided with four embedded anchors for handling.

Pipe scaffolding was used to support the center end of the folded-plate half-slab units, while the seven No. 11 reinforcing bars were butt welded, and the 25-in.-wide central concrete joint was poured and cured. An 8-in. longitudinal space was left between adjacent folded-plate slabs with reinforcing protruding for joining by concreting in place.

Facade of the manufacturing building shows asbestos louvers and plastic sheets that form the lateral siding on this building.



The finished-products end of the main building is protected by an interior sprinkler system. Note natural light filtered through the plastic sheets and reflected in by the louvers.

Concrete of 4,000 psi, instead of the specified 3000 psi, was used to fill the roof joints. The central supports were removed after seven days of curing time for the slab's central joint.

Considerable amounts of formwork and materials were saved by this construction procedure. About 1,100 sq ft of plywood formwork was required to cast 44,000 sq ft of folded-plate slab area, or 2.5 percent of the total area. Further, about 90 percent of the scaffolding that would have been required in a cast-in-place method was eliminated.

Using this design, the equivalent flat-slab thickness averaged $4\frac{3}{4}$ in. to span slightly more than 75 ft without intermediate support.

A total of 27,200 sq ft of floor area is covered by this roof. Concrete and steel reinforcement used for the folded-plate slab, including diaphragms, amounted to 515 cu yd and 130,600 lb respectively. The unit cost of the roof slab alone, but including impermeabilization, amounted to U. S. $1.59 per sq ft. Because of the low soil bearing capacity, which considerably increased the cost of the footings, and provision for a similar adjacent roof for expansion, the unit cost of the entire structure, including the hard-surfaced concrete flooring, was U. S. $3.36 per sq ft of useful floor area.

Du Pont's representative for the entire project on financing and general plant layout was P. C. Olin. Frederick Snare Corporation was the general building contractor. Valuable cooperation was received from H. Villa, general manager of the Du Pont Inter-America Chemical Company. Architectural and engineering design and construction supervision was by Saenz-Cancio-Martin, Alvarez y Gutierrez, engineers and architects.

ENGINEERS' NOTEBOOK

Time of concentration for overland flow

W. S. KERBY, J.M. ASCE, Hydrologist, Servis, Van Doren & Hazard, Engineers, Topeka, Kans.

Estimating the time of concentration of rainfall within a catchment area, or the critical time of supply, gives the designing engineer the greatest difficulty of all the variable factors in hydrology formulas, such as the rational formula. The method used, even by experienced designers of drainage systems, has been to estimate the time of concentration by a guess. The guess is usually smaller than the actual time of concentration to make sure that the system will be adequate for the runoff.

In the design of facilities with many small drainage areas, such as an urban roadway, it is necessary to estimate the time of concentration for each drainage area. Because the time of concentration has to be computed repeatedly, and because a small variation in this time makes a large difference in the discharge, a more convenient method to determine the time of concentration is needed. Such a method is here presented. It is an expansion of charts by Gail A. Hathaway, Past President ASCE ("Design of Drainage Facilities", ASCE *Transactions*, vol. 110, pp. 697-730, 1945).

The variables needed to compute the time of concentration for a catchment area are its length, slope and surface retardance of flow. All these variables can be computed from the survey field notes normally taken for designing.

The length, L, is the distance from the extremity of the catchment area in a direction parallel to the slope until a defined channel is reached. The units of L are in feet. It is considered that overland flow will become channel flow within 1,200 ft in all cases and less in most cases. If channelized flow occurs in a catchment area, the time of concentration will be the time of overland flow plus the time within the channel.

The slope S is the difference in elevation between the extreme edge of the catchment area and the point in question, divided by the horizontal distance between the two points. The units are in feet per foot.

The retardance coefficient, n, is the average surface retardance value of the overland flow. The following values should be used for computing n:

Type of Surface	Value of n
Smooth impervious surface	0.02
Smooth bare packed soil	0.10
Poor grass, cultivated row crops or moderately rough bare surface	0.20
Pasture or average grass	0.40
Deciduous timberland	0.60
Conifer timberland, deciduous timberland with deep forest litter or dense grass	0.80

As stated by Mr. Hathaway, "The rate of overland flow . . . is a function of the product of nL; hence, any combination of n and L values that gives the same product will result in the same rate of discharge." And "The discharge rate . . . is also a function of the quotient $\frac{S^{0.25}}{L^{0.50}}$." In utilizing these factors, it is found that

$$L'' = \frac{Ln}{4\sqrt{S}} \quad \text{.........(1)}$$

when converting the actual length, L, of a catchment area to a length, L'', required to obtain correct discharge by use of his supply curve charts.

In plotting L'' against the time of concentration t, from his supply curve charts, the empirical equation is:

$$L'' = \frac{t^{2.14}}{2.66} \quad \text{.........(2)}$$

Combining Eqs. 1 and 2

$$t^{2.14} = \frac{2Ln}{3\sqrt{S}} \quad \text{.......(3)}$$

After computing the retardance coefficient, the slope and the length, the nomograph for Eq. 3, Fig. 1, can be used for estimating the time of concentration for overland flow.

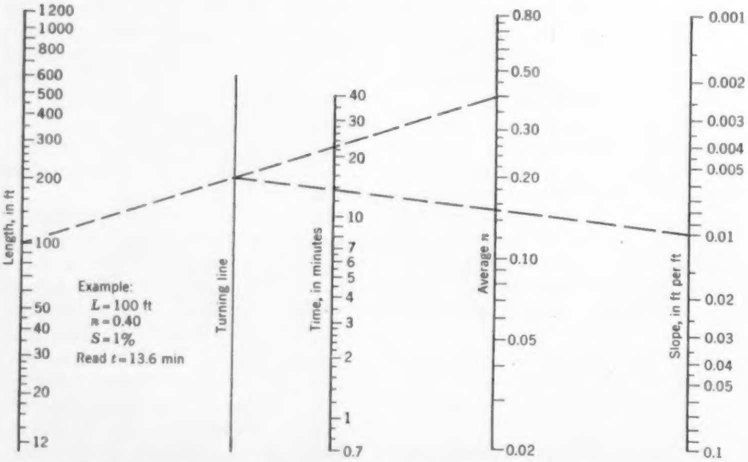


FIG. 1. Nomograph for determining time of concentration for overland flow.

Graphical integration aids deflection calculations by virtual work

CHARLES W. CUNNINGHAM, M. ASCE, Professor of Civil Engineering, The City College, New York, N. Y.

The analysis of continuous frames by virtual work, and the calculation of the deflections of beams and continuous frames by virtual work involve evaluation of the term $\int \frac{Mm\,dx}{EI}$. The purpose of this article is to reintroduce to the profession a general method for evaluating this term that does not involve actual integration or the use of special formulas. (See *Die Graphische Statik Der Baukonstruktionen* by Heinrich Muller-Breslau, vol. 2, Part II, pp. 54–71; "Graphical Methods in Structural Problems," a thesis by William Allan for the MCE degree, 1932, Polytechnic Institute of Brooklyn, pp. 70–76; and *Elastic Energy Theory* by J. A. Van Den Broek, John Wiley and Sons, Inc., pp. 52–57.)

This method, which is called graphical integration, is based on the concept that $\int \frac{Mm\,dx}{EI}$ represents a volume because there are three separate factors under the integral sign.

The M/EI diagram and the m diagram for a part of a flexural member are given in Fig. 1. For this general case, $\int \frac{Mm\,dx}{EI}$ becomes

$$\int \frac{M_x}{EI} m_x\,dx \quad \ldots\ldots\ldots\ldots (1)$$

The general equations for M_x and m_x, which would be substituted in this formula for an actual solution, must be valid over the limits of integration. By means of a three-dimensional coordinate system, Eq. 1 is plotted in Fig. 2. It should be evident from this figure that

(1) $\frac{M_x}{EI} m_x\,dx$ represents a differential volume.

(2) $\int_o^L \frac{M_x}{EI} m_x\,dx$ represents the summation of differential volumes over the distance L, which is equal to the actual volume of the right solid.

It can be shown that the volume of any right solid having a plane upper surface is equal to the area of the base multiplied by the height of the solid at the center of gravity of the base. If the M/EI diagram is used as the base of the solid, the top surface will always be a plane because the m diagram always consists of straight lines. When the shape of the M/EI diagram is such that its area and center of gravity cannot readily be determined, the diagram can be subdivided into simpler shapes whose properties are known.

In the article, "Simplified Deflection Calculations by Virtual Work," in the November 1958 issue (vol. p. 853), Elwood Heinz, J. M. ASCE, develops a formula (Eq. 4) for evaluating $\int \frac{Mm\,dx}{EI}$ for the special case of a linear relation between M and x. This formula is derived by substituting the linear Eqs. 1 and 2 of the article in $\int_o^L \frac{Mm\,dx}{EI}$ and then integrating the resulting expression.

The volume concept will now be used to evaluate $\int \frac{Mm\,dx}{EI}$ for the lower 20 ft of the left-hand column of the example presented by Mr. Heinz. The diagrams for M and m for this 20-ft length are given in Fig. 3. It should be noted that the upper limit of integration cannot exceed 20 ft because the general equation for m_x changes for $x > 20$ ft. For convenience in applying the rule for the volume of a right solid with a plane upper surface, the M diagram is resolved into triangles.

Then

$$\int_0^{20\times 12} \frac{M_x}{EI} m_x\,dx = \left\{\left[-75.2\times 10\times\frac{6.91}{13.58}(-10.82) - 9.2\times 10\times\frac{0.25}{13.58}(-10.82)\right]1{,}728\right\}$$

$$\times\frac{1}{30\times 10^3\times 1{,}200}$$

$$= \frac{(4{,}140+19)\,1{,}728}{30\times 10^3\times 1{,}200} = 0.20 \text{ in.}$$

This value is the horizontal deflection which is produced at Point 2 by flexure in the first 20 ft of the left-hand column.

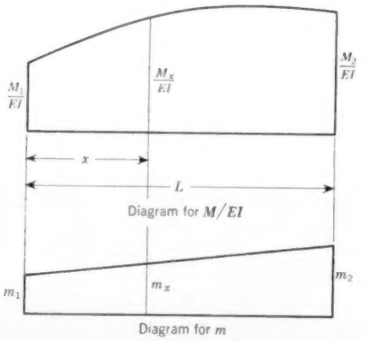


FIG. 1. Diagrams for M/EI and for m for a part of a flexural member.

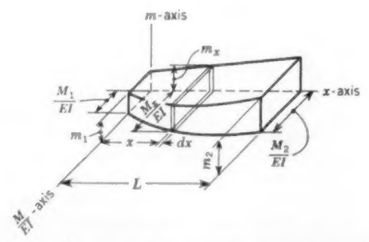


FIG. 2. Interpretation of Eq. 1 by means of a three-dimensional coordinate system.

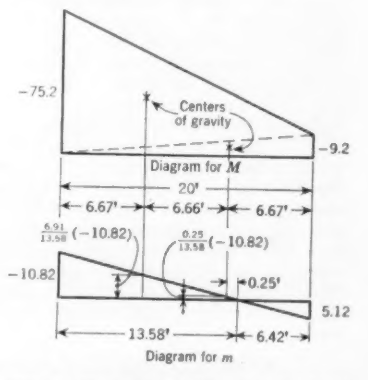


FIG. 3. Diagrams for M and m for lower 20 ft of left-hand column of example presented by Mr. Heinz.

THE READERS WRITE

Peaks on hanger influence lines previously investigated

To the Editor: Recently, while reading an old issue of Civil Engineering, I was deeply touched by an item, "Hungarian Refugees with Professional Training" (March 1957, vol. p. 213), outlining the efforts of the National Research Council and other groups in placing Hungarian refugees with advanced professional training.

Two years ago I arrived in this country with my family from Hungary. We had saved only our lives. I had no professional connections and did not speak English. Today as a structural engineer I have a professional license and a good position. I live a free and happy life in this wonderful country and for all this I am grateful to the people of the United States, especially to the many engineers who have helped me. But I am also grateful to my old teachers and masters in my native country who prepared me so well.

Another reference in Civil Engineering that has a special interest for me appeared in the article by Jerry C. L. Chang, "Electronic Computers Used in Design of Two Double-Deck Tied-Arch Bridges," in the November 1958 issue, vol. p. 850. Mr. Chang states that "In plotting the influence line for stress in the hangers . . . an unusual characteristic was observed. The influence line has a peak when the load is applied directly at the hanger in question . . . At first this was believed to be an experimental error."

Ten years ago Prof. Viktor Haviar presented a full solution of this problem, including the results of model investigations. Dr. Haviar was Chief Engineer of the Hungarian State Highway Department's Bridge Section, and I was his assistant. In addition to the model investigations, we designed and built two large steel-arch highway bridges and made load tests on them. The results confirmed his theory. The results of his research were published by the Third Congress of the International Association for Bridge and Structural Engineering, Liège, Belgium, Sept. 1948. (See the "Final Report," p. 517.)

His paper, "The Arch with Connected Stiffening Girder," gives the same basic equation for vertical continuity that appears in Mr. Chang's article, and the typical influence lines of the hangers appear with the peaks. These influence lines are from the model and the actual Hungarian highway bridges. Dr. Haviar's paper also gives solutions for moment distribution between the arch and the stiffening girder, and I recommend it highly to engineers who design arches with stiffening girders.

George Katanics, A. M. ASCE
Structural Engr., Palmer and Baker Engineers, Inc.
New Orleans, La.

Foreign students enjoy back copies of "Civil Engineering"

To the Editor: Enclosed is a letter I recently received from an engineering student in India. For some time now I have been sending him my copies of Civil Engineering after I finished reading them. Evidently he reads them from cover to cover.

Any engineer wishing to send magazines or books to engineering students, not only in India but in many other countries, may write to Mr. Harry Plissner, 345 West 58th Street, New York 19, N. Y. He will send original letters, one or more as desired, requesting almost any kind of reading material. The engineer may specify that if possible he would prefer to correspond with engineering students.

I wrote for three and Mr. Palhan, whose most recent letter appears below, just happened to be an engineer. I am sending books and magazines to a man in Israel and another in Taiwan. Believe me I have had lots of pleasure from sending letters to, and receiving them from these three. I believe this is a method of foreign aid that costs little, but will do much good.

W. F. Heath, M. ASCE
Office Engr., International Boundary & Water Commission
Benito, Tex.

Dear Mr. Heath: I thank you heartily once again for your trouble in sending me copies of Civil Engineering. I have just received the September issue. I liked the May 1958 issue—the electronic computation issue—very much and have read the whole of it. I can't help wondering if machines like the fast Remington Rand really exist. These machines must shake the very foundations of engineering design and calculations. Are you using any electronic computer in your office?

The September issue has come after a pretty long wait and surely I shall devour it in a few sittings. I had started thinking that you might have forgotten to send me any news, but I was surely mistaken in that. I will be appearing in January in the third examination of my course and then I will be in the final year.

You will be glad to know that India is making progress by leaps and bounds in all spheres of industrial activity—and we engineers have to play a prominent role in materializing the dreams of Mr. Nehru with regard to the reconstruction and resurgence of Young India and in maintaining the democratic ideals of our country.

I send you a great many congratulations for the success the Americans have achieved in setting an earth satellite, the famous "Explorer" in orbit around the earth. It is indeed an excellent achievement which will be recorded in golden letters in the history of mankind. I wish them all success in their further experiments with outer space and earth satellites.

Continue sending Civil Engineering—it is so informative and instructive that I do not want to miss any of its issues.

We are all keeping well and wish you and your family the same. With best wishes.

Yours sincerely,
Rajendar Kumar Palhan

6/1 W.E.A. Kawl Bagh
New Delhi, India

Bending-moment curves for beams

To the Editor: "Bending-Moment Curves for Beams with Loads Varying Uniformly from Zero," presented by Mr. Guérin in the January 1959 issue (vol. p. 30) seems to be of value only as an exercise in pure mathematics, as the author probably intended. It adds much complexity to the problem of finding actual bending moments along the beam, which can be determined by simple analytical procedures. Noting that

$$M_A = -\frac{1}{20}wL^2,\ V_A = \frac{7}{20}wL,$$

$$M_B = -\frac{1}{30}wL^2, \text{ and } V_B = \frac{3}{20}wL;$$

and letting x be measured toward the left from end B; we get

$$M_x = \left[-\frac{1}{30} + \frac{3}{20}\frac{x}{L} - \frac{1}{6}\left(\frac{x}{L}\right)^3\right] wL^2,$$

which is equivalent to, but simpler than Mr. Guérin's expression.

Divide the beam into 10 equal parts, that is, let x/L have values from 0, 0.1, 0.2, up to 1.0. Plot the moments as ordinates, as in the accompanying Fig. 1, to see that the points fall on a smooth parabolic curve. Inspection shows that the maximum moment occurs near the middle of the beam, it being 0.0214 wL^2 at 0.548 L from end B.

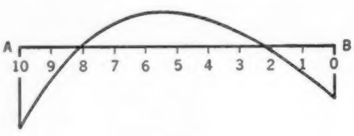


Fig. 1

T. F. Hickerson, M. ASCE
Formerly Prof. of Civil Eng., Univ. of North Carolina
Chapel Hill, N.C.

Cleveland Convention

Sheraton-Cleveland Hotel, Cleveland, Ohio **May 4-8, 1959**

REGISTRATION

Mezzanine Floor, Sheraton-Cleveland Hotel

2:00 p.m., Sunday, May 3. Each Convention day, 9:00 a.m. to 5:00 p.m.

Registration fee, $5.00 (except ladies and students.)

ICEBREAKER

Monday, May 4

5:30-7:00 p.m. **Ballroom**

Cocktails and Reception

First general gathering of the Convention for all members and their wives.

ADVANCE INFORMATION ON ATTENDANCE

To assure adequate preparation so that your attendance at the Cleveland Convention will be most enjoyable, the Committee requests your assistance. It will be most helpful to know how many are to be expected at the various functions. Please use the coupon on p. 125, which is to be sent to W. R. Swatosh, Convention Chairman.

This does not constitute registration. It will be necessary to register when you arrive at the Convention.

Do not send a check covering all events. The only event for which advance payment will be required is the Dinner Reception on May 6, as explained in the program.

Your help in furnishing this advance information will facilitate the planning work of the Committee.

HOTEL ACCOMMODATIONS

Headquarters of the Cleveland Convention will be at the Sheraton-Cleveland Hotel, Public Square and Superior Avenue. Special arrangements have been made to accommodate many Convention visitors at the headquarters hotel, up to capacity, in the order in which reservation requests are received. Send your reservation request early to assure space at the headquarters hotel. For your convenience, a special request form is provided on p. 125. Late requests may have to be assigned to other nearby hotels.

AUTHORS' BREAKFASTS

Dining Rooms 1 and 3, Sheraton-Cleveland Hotel

8:15 a.m. each Convention day

Briefing sessions for speakers, discussers and program officials by invitation only.

Presiding: HOMER T. BORTON, Co-chairman, Cleveland Convention Committee.

Per plate $1.00. Tickets should be purchased before each meal.

MAYOR'S LUNCHEON

Grand Ballroom, Sheraton-Cleveland Hotel

12:30 p.m., Monday, May 4

Greetings from Cleveland by: HON. ANTHONY J. CELEBREZZE, Mayor, City of Cleveland.

Speaker: HARRY C. KELLY, Asst. Director for Scientific Personnel and Education, National Science Foundation.

Subject: Approaches to the Problem of Improving Quality of Education in Civil Engineering Education

Presiding: FRANCIS S. FRIEL, President, ASCE.

Vice President, Zone III: LLOYD D. KNAPP

Toastmaster: JOHN B. SCALZI, Associate Professor, Structural Engineering, Case Inst. of Technology.

Per plate, $4.00. Tickets for this event should be purchased before 10:00 a.m. on Monday.

LOCAL SECTIONS CONFERENCE

Monday, May 4 and Tuesday, May 5

Parlor 31

MONDAY MORNING MAY 4

Irrigation and Drainage Division

9:30 a.m. **Rose Room**

***Presiding:* G. B. Keesee, Chairman, Committee on Research**

Results of Questionnaire on Research in the Irrigation and Drainage Field

9:30 **Purpose, Outline of Questionnaire, and Summary of the Results Obtained from It**

GERALD B. KEESEE, Area General Engr., Gallup Area, Bur. of Indian Affairs, Dept. of the Interior, Gallup, N.Mex.

10:00 **Research Needs in Supply and Conveyance of Water**

MAURICE L. ALBERTSON, Director, Research Foundation, Colorado State Univ.; and HARRY F. BLANEY, JR., Sales Engr., Amer. Rolling Mill Co., Los Angeles, Calif.

10:30 **Research Needs in Distribution and Application of Water**

DEL G. SHOCKLEY, Civil Engr. (Irrigation), Eng. and Watershed Planning Unit, Soil Conservation Service, Dept. of Agriculture; and ROBERT L. HARDMAN, Supervising Engr., Division of Water Policy and Supply Dept. of Conservation and Economic Development, State of New Jersey.

11:00 **Research Needs in Soil-Plant Relationship**

DEAN PETERSON, Utah State Univ.; and ALVIN BISHOP, Utah State Univ.

11:30 **Vortex-Tube Sand Trap**

A. R. ROBINSON, Agricultural Engr., Agricultural Research Service, Colorado State Univ.

Eng. Mechanics Division

9:30 a.m. Cleveland Room

Plasticity

Presiding: B. Johnston, Member, Exec. Committee

9:30 **Eccentrically Loaded, Hinged Steel Columns**

R. E. Mason, Asst. Prof.; G. P. Fisher, Assoc. Prof.; and G. Winter, Prof. and Head of Dept. of Structural Eng.; Cornell Univ., Ithaca, N. Y.

10:00 **Inelastic Lateral-Torsional Buckling of WF Steel Columns**

T. V. Galambos, Research Assoc., Fritz Lab., Lehigh Univ., Bethlehem, Pa.; and R. L. Ketter, Prof. and Head of Civil Eng. Dept., Univ. of Buffalo, N. Y.

10:45 **The Neutral Axis in Plastic Bending of Beams**

Aris Phillips, Assoc. Prof. of Civil Eng., Yale Univ., New Haven, Conn.

11:30 **Ultimate Strength Criteria for Reinforced Concrete**

L. B. Kriz, Asst. Development Engr., Portland Cement Assoc., Skokie, Ill.

Sanitary Eng. Division

9:30 a.m. Terminal Room

Presiding: Harry H. Mosely, Member, Committee on Session Programs

9:30 **Planning Cleveland's Water Program**

Jasper W. Avery, Partner, Havens and Emerson, Cleveland, Ohio.

10:15 **Sanitary and Storm-Sewer Program for Cuyahoga County, Ohio**

Alfred A. Estrada, Albright and Friel, Philadelphia, Pa.

11:00 **Use of Lake Erie Water Within the Watershed**

Frank W. Edwards, Associate and Manager, Stanley Eng. Co., Chicago, Ill.

Pipeline Division and Power Division

9:30 a.m. Empire Room

Presiding: Joe E. Thompson, Member, Exec. Committee, Pipeline Div.

9:30 **The Coal Pipeline**

V. D. Hanson, Chief Mechanical Engr., Consolidated Coal Co., Pittsburgh, Pa.

10:15 **Pumping Solids Through Pipelines**

Julian Nardi, Ford, Bacon and Davis, New York, N. Y.

11:00 **Civil Engineering Features of the Eastlake Station**

L. A. Olson, M. ASCE, Engr., The Cleveland Electric Illuminating Co., Cleveland, Ohio.

Soil Mech. and Foundations Div. and Construction Div.

9:30 a.m. Whitehall Room

Session co-sponsored by Committee on Control of Groundwater for Engineering Purposes and the Construction Division

Presiding: Gerald Leonards, Secretary, Exec. Committee

9:30 **Principles and Methods of Ground-Water Control in Excavations**

William F. Swiger, Consulting Engr., Stone and Webster Eng. Corp., Boston, Mass.

10:30 **Design of Dewatering and Pressure Relief Systems**

Charles I. Mansur, Chief Engr., Luhr Bros., Inc., Columbia, Ill.; and Robert I. Kaufman, Chief, Geology, Soils and Materials Branch, Miss. River Commission, Vicksburg.

11:30 **Installation and Operation of Dewatering Systems**

David Werblin, Vice President, Griffin Wellpoint Corp., New York, N. Y.

MONDAY AFTERNOON

MAY 4

Eng. Mechanics Division

2:30 p.m. Cleveland Room

Elasticity

Presiding: John W. Clark, Member, Committee on Elasticity

2:30 **On Longitudinal Waves in an Elastic Plate**

E. G. Volterra, Prof., Dept. of Mechanics, Univ. of Texas, Austin; and E. C. Zachmanoglou, I. B. M. Fellow, Univ. of Calif., Berkeley.

3:00 **The Analysis of Loaded Flexible Surfaces over Subgrades with Viscoelastic Material Behaviour**

B. C. Hoskin, Aero Research Labs., Melbourne, Australia; and E. H. Lee, Prof. of Applied Mathematics, Brown Univ., Providence, R. I.

3:30 **The Rapid Design of Beams in Torsion**

C. Marsh, Aluminum Co. of Canada, Montreal.

4:00 **Solutions for One-Dimensional Structural Lattices**

Donald L. Dean, Assoc. Prof. of Civil Eng.; and Selmo Taubert, Asst. Prof., Dept. of Mathematics, Univ. of Kansas, Lawrence.

Pipeline Division and Power Division

2:30 p.m. Empire Room

Presiding: F. C. Culpepper, Member, Exec. Committee, Pipeline Div.

2:30 **Coal Pipeline Construction**

David R. Williams, Williams Bros., Tulsa, Okla.

3:15 **Design and Operation of Drying Plant**

C. A. Dauber, Director, Civil and Mechanical Eng., The Cleveland Electric Illuminating Co.

4:00 **Installation of 138-kv Pipe-Type Cable in Cleveland**

J. J. Pokorny, M. AIEE, Supervising Engr., Cable Section, The Cleveland Electric Illuminating Co.

Irrigation and Drainage Division

2:30 p.m. Rose Room

Sponsored by Committee on Ground Water

Presiding: Robert O. Thomas, Secretary, Committee on Ground Water

Utilization of Ground-Water Storage Capacity

2:30 **Developments in Geophysical Procedures for the Location and Utilization of Subsurface Water**

Harris R. McDonald, Supervising Hydraulic Engr., USBR; and Dart Wantland, Geophysicist.

3:00 **Artificial Recharge of Ground Water**

Raymond C. Richter, Supervising Eng. Geologist; and Robert Y. O. Chun, Associate Hydraulic Engr.; Calif. Dept. of Water Resources.

3:30 **Water Quality Considerations in Ground-Water Basin Operation**

MEYER KRAMSKY, Principal Hydraulic Engr., Calif. Dept. of Water Resources, Sacramento.

4:00 **Legal Problems in Ground Water Utilization**

ROBERT O. THOMAS, Supervising Hydraulic Engr., Calif. Dept. of Water Resources, Sacramento.

Sanitary Eng. Division

2:30 p.m. Terminal Room

Presiding: Arthur D. Caster, Secretary, Exec. Committee

2:30 **Law On Ground Water Rights in Eastern States**

WILLIAM M. GATES, Partner, Squire, Sanders and Dempsey, Counsellors at Law, Cleveland, Ohio.

3:15 **Russian Water Supply and Treatment Practices**

VINCENT J. C. CALISE and W. H. HOMER, Graver Water Conditioning Co., New York, N. Y.

4:00 **Wet Air Oxidation of Sewage Sludge**

E. HURWITZ, Director of Labs., Metropolitan Sanitary Dist. of Greater Chicago, Ill.

Soil Mechanics and Foundations Division

2:30 p.m. Whitehall Room

Session sponsored by Committee on Control of Groundwater for Engineering Purposes

Presiding: J. O. Osterberg, Vice Chairman, Exec. Committee

2:30 **Dewatering the Port Allen Lock Excavation**

CHARLES I. MANSUR, Chief Engr., Luhr Bros., Inc., Columbia, Ill.; and ROBERT I. KAUFMAN, Chief, Geology, Soils and Materials Branch, Miss. River Commission, Vicksburg.

3:15 **Application of Deep Wells to Dewatering—New York Varved Silts**

JAMES D. PARSONS, Associate Partner, Moran, Proctor, Mueser, Rutledge, New York, N. Y.

4:00 **Contemporary Tools for Dewatering**

BYRON J. PRUGH, Research Div., Moretrench Corp., Tampa, Fla.

TUESDAY MORNING

MAY 5

Highway Division

9:30 a.m. Terminal Room

Sponsored by Committee on Urban Transportation

Presiding: Norman Kennedy, Chairman, Committee on Urban Transportation

9:30 **Factual Data Required for Urban Transportation Planning**

RALPH R. BARTELSMEYER, Chief Highway Engr., Illinois Div. of Highways.

10:00 **How to Utilize Factual Data in Urban Transportation Planning**

NATHAN CHERNIACK, Economist, Comprehensive Planning Div., Port of New York Authority.

10:30 **Freeway and Subway Planning and Operation in the Toronto Area**

RAYMOND J. DESJARDINA, Director of Transportation Div., Metropolitan Toronto Planning Board.

11:00 **Review of Some Recently Completed Urban Transportation Plans**

E. H. HOLMES, Asst. Commissioner, Bur. of Public Roads.

Irrigation and Drainage Division

9:30 a.m. Rose Room

Humid Areas Committee

Presiding: M. C. Boyer, Chairman of Committee on Humid Areas

Correlation of Irrigation and Drainage for Crop Production in Humid Regions.

9:30 **The Irrigation and Drainage of Indiana Muck Lands**

ERNEST MUNTER, Rensselaer, Ind.

10:30 **Water Rights Laws Pertaining to Irrigation and Drainage**

ROBERT L. SMITH, Topeka, Kan.

11:30 **Drainage as Related to Irrigation in New Jersey**

ROBERT L. HARDMAN, Dept. of Conservation and Development, Trenton, N. J.

Soil Mechanics and Foundations Division

9:30 a.m. Whitehall Room

Sponsored by Committee on Frost Action and Permafrost

Presiding: Ralph Fadum, Member, Executive Committee

9:30 **Permafrost Aspects of Hudson Bay Railroad**

J. L. CHARLES, Consultant to Canadian National Railways, Winnepeg, Manitoba.

10:15 **Construction and Performance of a Pier-Supported Building at Churchill on Hudson Bay**

H. BRIAN DICKENS, Canadian National Research Council of Canada; and D. M. GRAY, Dept. of National Defense, Ottawa, Ont.

11:00 **Driven Steel Piles in Permafrost**

JOHN IRETON, Alaska District, U. S. Army Corps of Engineers, Anchorage, Alaska.

Structural Division and Eng. Mechanics Division

9:30 a.m. Cleveland Room

Electronic Computation

Presiding: Sidney Shore, Member, Committee on Electronic Computation, Structural Div., and E. F. Masur, Chairman, Committee on Mathematical Methods, Eng. Mechanics Div.

9:30 **Solutions of Large Systems of Linear Equations**

A. H. MCMORRIS, Dept. of Electrical Eng., Univ. of Houston, Tex.

10:00 **Analysis of Conical Shells by Electronic Computer**

JOHN GOLDBERG, Dept. of Civil Eng.; JOHN L. BOGDANOFF, Div. of Eng. Sciences, Purdue Univ., Lafayette, Ind.; and LEE MARCUS, Allison Div., General Motors Corp., Indianapolis, Ind.

10:30 **Dynamic Response of Multistory Elasto-Plastic Frame by Computer**

GLEN BERG, Eng. Research Inst., Univ. of Michigan, Ann Arbor.

11:00 **Joint Displacements in Ideal Trusses**

DONALD DADEPPO, Univ. of Michigan, Ann Arbor.

Waterways and Harbors Division

9:30 a.m. Empire Room

Sponsored by Committee on Research and Committee on Regulation and Stabilization of Rivers

Presiding: R. O. Eaton, Member, Exec. Committee

9:30 **Methods of Calculating Tidal Action in Canals**

H. A. EINSTEIN, Prof.; and J. A. HARDER, Asst. Prof., Hydraulic Eng., Univ. of Calif., Berkeley.

10:00 The Effect of Seiches at Conneaut Harbor

Ira A. Hunt, Dist. Engr.; and Leonas Bajorunas, Chief, Special Studies Section, U. S. Lake Survey, Detroit, Mich.

10:30 Diversion of the Missouri River at Oahe Dam

A. S. Harrison and L. S. Horihan, Hydraulic Engrs.; and J. Norman Gau, Construction Engr., U. S. Army Engr. Dist., Omaha, Nebr.

GENERAL MEMBERSHIP LUNCHEON

Grand Ballroom, Sheraton-Cleveland Hotel

12:30 p.m. **Tues., May 5**

Speaker: Ellis L. Armstrong, Commissioner, Bureau of Public Roads, U. S. Dept. of Commerce.

Subject: The National Highway Program—Progress Report

Presiding: Francis S. Friel, President, ASCE

Chairman: William B. Hanlon, President, Cleveland Section, ASCE; Asst. Vice President for Eng., Medusa Portland Cement Co.

Toastmaster: Albert S. Porter, Cuyahoga County Engr.

Per plate $4.00. Tickets for this event should be purchased before 10:00 a.m. on Tuesday.

TUESDAY AFTERNOON

MAY 5

Soil Mechanics and Foundations Division

2:30 p.m. Whitehall Room

Presiding: Stanley J. Johnson, Chairman, Exec. Committee

2:30 Load Tests on Intrusion-Prepakt Piles

Lawrence A. DuBose, Director of Eng., Testing Service Corp., Lombard, Ill.

3:15 An Analysis of Concrete Slabs on Ground

Gerald Leonards, Prof. of Soil Mechanics; and Milton E. Harr, Asst. Prof. of Soil Mechanics, Purdue Univ., Lafayette, Ind.

4:00 Strength Characteristics of Compacted Clays

H. Bolton Seed, Assoc. Prof. of Civil Eng., Univ. of California, Berkeley.

4:30 Engineering Education in the USSR

Ralph Fadum, Member, Exec. Committee; Prof. and Head, Dept. of Civil Eng., North Carolina State College, Raleigh, N. C.

Structural Division and Eng. Mechanics Division

2:30 p.m. Cleveland Room

Electronic Computation

Presiding: Elmer K. Timby, Vice Chairman, Exec. Committee

2:30 Computer Design of a Multistory Frame Building

A. M. Lount, Consulting Engr., A. M. Lount & Associates, East Toronto, Ontario.

3:15 Computer Design of Power Plant Framing

John H. Wells, Jackson & Moreland, Inc., Boston, Mass.

4:00 Analysis of Rigid Frames

Ardis H. White, Dept., of Civil Eng., Univ. of Houston, Tex.

4:30 Design of Prestressed Beams by Computer

Joseph Bonasia, Lockwood, Kessler & Bartlett, Syosset, N. Y.

Surveying and Mapping Div. and Highway Division

2:30 p.m. Terminal Room

2:30 Recent Developments in Photogrammetric and Electronic Surveying Equipment

Roland H. Moore, Asst. Chief Topographic Engr., U. S. Geological Survey, Washington, D. C.

3:00 Large-Scale Mapping of Cleveland

G. Brooks Earnest, President, Fenn College, Clevland, Ohio.

3:45 Surveying in the Civil Engineering Curriculum

Moderator: Robert H. Dodds, Gibbs and Hill, Inc., New York, N. Y.

For Private Practice

Benjamin E. Beavin, Sr., Baltimore, Md.

For Government Agencies

G. C. Tewinkel, Chief of Research, Photogrammetry Div., U. S. Coast and Geodetic Survey, Washington, D. C.

For Education

Kenneth S. Curtis, Asst. Prof., Purdue Univ., Lafayette, Ind.

Waterways and Harbors Division

2:30 p.m. Empire Room

Sponsored by Committee on Navigation and Flood Control Facilities

Presiding: R. O. Eaton, Member, Exec. Committee

2:30 Deep-Draft Navigation on the Great Lakes

Walter E. McDonald, Chief, Planning and Reports Branch, U. S. Army Engineers, North Central Div.

3:00 Approach to the Study of Overseas Cargo Potentials

Wilfred G. McLennan, Chief, Transportation Economics Branch, U. S. Army Engineers, North Central Div.

3:30 Navigation and Flood Control Features of the Barkley Project

Frank P. Gaines, Chief, Engineering Div., U. S. Army Engr. Dist., Nashville, Tenn.

FIELD TRIP OF PIPELINE AND POWER DIVISIONS

9:00 a.m., Tuesday, May 5

Inspection of Typical Pumping Station Along Route of Coal Pipeline

Busses will leave Sheraton-Cleveland Hotel at 9:00 a.m. for Atwater, Ohio, to inspect pumping station.

On the trip north to Eastlake, Ohio, the group will stop for lunch.

At the Eastlake Station, guided tours will be provided through both the power plant and the coal drying plant.

FIELD TRIP OF SANITARY ENGINEERING DIVISION

Tuesday, May 5

9:30 a.m.

Inspection of Waste Disposal Plant of the Cleveland Refinery of Standard Oil Co. of Ohio.

Transportation will leave Hotel Sheraton-Cleveland at 9:30 and will return before lunch.

Tickets may be purchased at the registration counter for $1.50 before 5:00 p.m. on Monday, May 4.

WEDNESDAY MORNING

MAY 6

General Business Meeting

9:00 a.m. Cleveland Room

President's Annual Address

Transaction of Society Business

Conditions of Practice

9:30 a.m. Cleveland Room

Presiding: Waldo G. Bowman, Chairman, Dept. of Conditions of Practice

9:30 **Report of Committee on Salaries**

OSCAR S. GRAY, Chairman; Project Manager, Jackson and Moreland, Boston, Mass.

Professional Development of Civil Engineers

Moderator: G. Brooks Earnest, President, Fenn College

10:00 **Professional Development in the Medical Profession**

ROBERT WILLIAMS, Asst. Dean, School of Medicine, Western Reserve Univ., Cleveland.

11:00 **Methods of Accomplishing Professional Development**

NATHAN W. DOUGHERTY, Dean Emeritus of Engineering, Univ. of Tennessee, Knoxville.

11:40 **The First Five Years of Professional Development—a Resurvey**

CORNELIUS WANDMACHER, Associate Dean, College of Eng., Univ. of Cincinnati, Ohio.

MEMBERSHIP LUNCHEON

Grand Ballroom Sheraton-Cleveland Hotel

12:30 p.m. Wed., May 6

Speaker: HARRY F. BURMESTER, President, Union Commerce Bank.

Subject: The Civil Engineer and Money Markets

Presiding: FRANCIS S. FRIEL, President, ASCE.

Chairman: WENDELL R. SWATOSH, General Chairman, Cleveland Convention Committee.

Toastmaster: G. BROOKS EARNEST, President, Fenn College.

Per plate, $4.00. Tickets for this event should be purchased before 10:00 a.m. on Wednesday

WEDNESDAY AFTERNOON

MAY 6

City Planning Division

2:30 p.m. Whitehall Room

Presiding: J. Cal Callahan, Chairman, Exec. Committee

2:30 **Planning Activities in the City of Cleveland**

ERIC A. GRUBB, Planning Director, Cleveland, Ohio.

3:00 **Planning Activities in the Cleveland Region**

STEPHEN A. KAUFMAN, Chief Planner, Regional Planning Commission, Cleveland, Ohio.

3:30 **Planning Activities in the Suburban Communities**

FRED J. ABENDROTH, Chief Planner, Regional Planning Commission, Cleveland, Ohio.

Highway Division

2:30 p.m. Terminal Room

Sponsored by Committee on Maintenance and Operation

Adequacy of Services for the Traveling Public on Controlled Access Highways

Panel Members:

CHARLES L. DEARING, Exec. Director, Illinois State Toll Highway Commission.

C. W. HARTFORD, Exec. Director, Ohio Turnpike Commission.

ROSS C. KEELING, Asst. Chief Engr., Kansas Turnpike Authority.

ERNEST PERKINS, Asst. Chief Engr., Connecticut State Highway Dept.

Hydraulics Division

2:30 p.m. Rose Room

Sponsored by Committee on Flood Control

Presiding: Harold M. Martin, Member, Exec. Committee, and Joseph I. Perrey, Chairman, Committee on Flood Control

2:30 **Conservancy Districts as Flood Control Agencies**

C. C. CHAMBERS, Consulting Engr., Dayton, Ohio.

3:00 **Operation of the Miami Conservancy District for Flood Control**

MAX L. MITCHELL, Chief Engr., Miami Conservancy Dist., Dayton, Ohio.

3:30 **Flood Control and Other Benefits of Muskingum Conservancy District**

TOM C. SHULER, Chief Engr., Muskingum Watershed Conservancy Dist., New Philadelphia, Ohio.

Pipeline Division

2:30 p.m. Parlor 34

Presiding: R. E. Kling, Chairman, Program Committee

2:00 **Thermal Electric Pipeline Supplies Hi-Vis Fuel to New Generating Station**

A. C. PURDUE, Fluid Systems, Inc., New Haven, Conn.

2:45 **Electronic Pressure Control for Pipeline Pumping Stations**

W. M. SORENSON, Design Group Supervisor, Sohio Pipeline Co., St. Louis, Mo.

3:30 **Motion Picture: The Toughest Inch**

Construction picture, in color and sound, of 262-mile pipeline, presented by Columbia Gas System.

Structural Division

2:30 p.m. Cleveland Room

Nuclear Structures and Materials

Divergent Philosophies Affecting the Layout and Structural Features of Alpha-Gamma Hot-Cell Design

Presiding: H. M. Glen, Vice Chairman, Committee on Nuclear Structures and Materials

2:30 **General Aspects of Plutonium Confinement Within Hot Cells**

H. M. GLEN, Supervising Structural Design Engr., Oak Ridge National Lab., Tenn.

2:45 **Plutonium Confinement Within a Typical Beta-Gamma Hot Cell**

GEO. E. PARKER, Project Engr., Vitro Eng. Div., New York, N. Y.

3:15 **Alpha-Gamma Hot Cells Utilizing Maximum Personnel Setup and Maintenance**

JOHN M. RUDDY, Brookhaven National Lab., Upton, Long Island, N. Y.

3:45 **Alpha-Gamma Hot Cells Utilizing Maximum Remote Setup and Maintenance**

K. R. FERGUSON, Remote Control Eng. Div., Argonne National Lab., Lemont, Ill.

Waterways and Harbors Division

2:30 p.m. Empire Room

Sponsored by Committee on Coastal Engineering

2:30 **Methods of Correcting Wave Problems in Harbors**

Ernest F. Brater, Prof. of Hydraulic Eng., Univ. of Michigan, Ann Arbor.

3:30 **Investigation of Bluff Recession Along Lake Erie**

Robert Chieruzzi, Civil Eng. Dept., Univ. of So. California; and Robert F. Baker, Director, Civil Eng. Research, Ohio State Univ., Columbus.

4:30 **Engineering Geology of Ohio Shoreline of Lake Erie**

Howard J. Pincus, Assoc. Prof. of Geology, Ohio State Univ., Columbus.

THURSDAY MORNING

MAY 7

City Planning Division

9:30 a.m. Whitehall Room

Presiding: J. Cal Callahan, Chairman, Exec. Committee

Panel Chairman: Curtis Lee Smith, President, Cleveland Chamber of Commerce

Public's Stake in Revitalized Public Transit

The Shopper

Larry Smith, Consultant to the Higbee Co., Cleveland, Ohio.

Central City

Edmond T. Bacon, Director of Planning, Philadelphia, Pa.

Regional Area

Proctor Noyes, Director, Regional Planning Commission, Cleveland, Ohio.

Public Viewpoint

Louis B. Seltzer, Editor, Cleveland Press.

Power Division

9:30 a.m. Terminal Room

Presiding: G. J. Vencill, Member, Exec. Committee.

9:30 **Civil Engineering Features of the Stratton Power Station**

C. H. Alban, Project Engr., Commonwealth Associates, Inc., Jackson, Mich.

9:45 **Procedure for Plant Layout**

R. G. Stewart, Senior Engr., The Cleveland Electric Illuminating Co., Ohio.

10:30 **Alterations and Additions to Frank M. Tait Power Station**

C. R. Dole, Chief Civil Engr., Dayton Power and Light Co., Dayton, Ohio; and Richard Gerhart, Design Engr., Gilbert Associates, Reading, Pa.

11:15 **Additional Civil Engineering Aspects of Enrico Fermi Plant**

N. L. Scott, and R. F. Mantey, ANS Commonwealth Associates, Inc., Jackson, Mich.

DINNER AND RECEPTION

Wed., May 6 **Ballroom**

7:00 p.m. Assembly in Ballroom

7:30 p.m. Dinner in Ballroom

Toastmaster: Homer T. Borton, President, Osborn Eng. Co., and President, Ohio Society of Professional Engineers.

Speaker: Ralph M. Besse, Exec. Vice President, Cleveland Electric Illuminating Co.; Chairman, Cleveland Commission on Higher Education.

Subject: A Look at Northeastern Ohio in the Year 2000

For this social evening, special reservations can be made for tables seating 10 persons each. Members may underwrite complete tables, or pool reservations with others.

The published seating list will close at 2:00 p.m. Tuesday, May 5. Tickets purchased after that hour will be assigned to tables in order of purchase. Sale of tickets will be limited to the capacity of the Ballroom.

Dinner dress (informal). Per plate, \$7.50.

Mail orders for tables must be accompanied by a check in full, and list of guests. Send order and check to:

James M. Hicks, *Secretary,*
Cleveland Section ASCE
2950 Corydon Road
Cleveland Heights 18, Ohio

Hydraulics Division

9:30 Rose Room

Sponsored by Committee on Hydraulic Structures

Presiding: Harold M. Martin, Member, Exec. Committee, and Glenn E. Hands, Chairman, Hydraulic Structures Committee

9:30 **Use of Submergible Gates at Navigation Structures**

E. E. Abbott and A. J. Moors, Ohio River Div., Corps of Engineers, Cincinnati, Ohio.

10:00 **Model Tests of Submergible Tainter Gates**

Thomas E. Murphy, Chief, Hydraulic Structures Sect., U. S. Waterways Experiment Sta., Corps of Engrs., U. S. Army, Vicksburg, Miss.

10:30 **Relative Performance of Current Meters in Gaging the Discharge of the Outfall Rivers of the Great Lakes**

F. Wayne Townsend, and Frank A. Blust, Hydraulics and Hydrology Branch, U. S. Lake Survey, Corps of Engineers, Detroit, Mich.

Structural Division and Construction Division

9:30 a.m. Cleveland Room

Nuclear Structures and Materials

Presiding: John E. Goldberg, Member, Committee on Nuclear Structures and Materials, Structural Div.

9:30 **Containment Problems**

Stuart McLain, Nuclear Consultant, Argonne National Lab., Lemont, Ill.

10:00 **Pressure Volume Considerations for Reactor Containment Vessels**

John A. Bailey, Atomic Power Equipment Dept., General Electric Co., San Jose, Calif.

10:50 **A New Approach to Heat and Power Generation from Contained Nuclear Explosions**

Francis B. Porzel, Senior Scientific Adviser, Armour Research Foundation, Chicago, Ill.

11:30 **Seismic Aspects of Nuclear Facilities**

Reuben R. Alvey, Chief Engr., Nuclear Div., Holmes & Narver, Inc., Los Angeles, Calif.

FIELD TRIP OF WATERWAYS AND HARBORS DIV.

Thursday, May 7

Inspection trip by boat of dock facilities along Cuyahoga River.

STUDENT CONFERENCE

10:00 a.m. Empire Room

10:00 **Introductions**

Welcome by FRANCIS S. FRIEL, President, ASCE

10:40 **Prestressed Concrete**

An illustrated talk by George Vaught, of Concrete Masonry Corp., dealing with the present and future of prestressed concrete.

MEMBERSHIP LUNCHEON

Grand Ballroom Sheraton-Cleveland Hotel

12:30 p.m. Thurs., May 7

Speaker: ROBERT F. LEGGET, Director, Div. of Building Research, National Research Council, Canada.

Subject: Engineering Astride the Border

Presiding: FRANCIS S. FRIEL, President, ASCE.

Chairman: JOHN C. KING, Manager of Sales, Intrusion-Prepakt, Inc.

Toastmaster: C. MERRILL BARBER, Partner, Barber, Magee and Hoffman.

Per plate $4.00. Tickets for this event should be purchased before 10:00 a.m. Wednesday.

THURSDAY AFTERNOON

MAY 7

City Planning Division

2:30 p.m. Whitehall Room

Panel Chairman: D. C. Hyde, General Manager, Cleveland Transit System

Public Transit Improvement Programs

Industry Trends

WALTER S. RAINVILLE, Director of Research, American Transit Association, New York, N. Y.

Chicago

WALTER J. MCCARTER, General Manager, Chicago Transit Authority.

Toronto

W. E. P. DUNCAN, General Manager, Toronto Transit Commission.

Cleveland

RALPH WOOD, Supt., Eng. Power and Plant, Cleveland Transit System.

Hydraulics Division

2:30 p.m. Rose Room

Sponsored by Committee on Hydromechanics

Presiding: Harold M. Martin, Member, Exec. Committee, and John F. Ripken, Chairman, Hydromechanics Committee

2:30 **Flow Conditions at the Entrance of a Pipe**

HAROLD A. HENRY, Asst. Prof. of Civil Eng., Michigan State Univ., East Lansing.

3:00 **Behavior of Bubbles in a Vibrating Liquid**

RICHARD SKALAK, Dept. of Civil Eng., Columbia Univ., New York, N. Y.

3:30 **Laboratory Development of the Contra Costa Culvert Outfall Energy Dissipator**

S. RUSSELL KEIM, Dept. of Theoretical and Applied Mechanics, Univ. of Illinois, Urbana.

Power Division

2:30 p.m. Terminal Room

Presiding: R. W. Ott, Member, Committee on Session Programs

2:00 **Raising Transmission Towers with Energized Lines**

A. G. MASTERS, General Supervising Engr.; and E. J. GESING, Senior Engr., The Cleveland Electric Illuminating Co., Cleveland, Ohio.

2:45 **Swift Hydroelectric Project—a Completion Report**

M. L. DICKINSON, Chief Hydraulic Engr., Bechtel Corporation, Los Angeles, Calif.

3:30 **Intakes, Screens, and Log Booms —Design, Maintenance and Operation.**

Report by Division's Committee on Operation and Maintenance of Hydroelectric Generating Stations: KARL O. STRENGE, JR., H. G. HUNT, M. G. SALZMAN, A. SHANNON, and J. N. SPAULDING.

Structural Division and Construction Division

2:30 p.m. Cleveland Room

Nuclear Structures and Materials

Presiding: Abbott Frank, Member, Committee on Nuclear Structures

2:30 **Containment of Fragments from Runaway Reactors**

NORMAN R. ZABEL, Poulter Lab., Stanford Research Inst., Menlo Park, Calif.

3:10 **Containment Criteria for Organic Moderated Power Reactors**

JOHN F. STOLZ, Project Engr., Atomics International, Canoga Park, Calif.

3:50 **The Shippingport Reactor—Criteria and Basis of Design of the PWR Reactor Plant Container**

R. F. DEVINE, Supervising Engr., PWR Plant Eng. Section, Bettis Atomic Power Div., Westinghouse Electric Corp., Pittsburgh, Pa.

4:30 **The Shippingport Reactor—Execution of the Design of the PWR Reactor Plant Container**

JOHN J. NILAND, Design Engr., Stone and Webster Eng. Corp., Boston, Mass.

FIELD TRIP, WATERWAYS AND HARBORS DIVISION

Boat Trip on Cuyahoga River to inspect facilities.

STUDENT CONFERENCE

2:30 p.m. Empire Room

2:30 **After College, What?**

A panel discussion by students of various colleges on the subject of jobs and professional development.

4:30 **Development of National Water Resources**

HERBERT D. VOGEL, Brig. Gen. Retired, Corps of Engineers, U. S. Army; Chairman of Board, Tennessee Valley Authority.

BUFFET DINNER

Thursday, May 7

At Cleveland Engineering and Scientific Center

6 to 7 p.m., Assembly and cocktails

7 to 8:30 p.m., Dinner (dress, informal)

Speaker: FREDERICK C. CRAWFORD, Chairman of Exec. Committee, Thompson - Ramo - Wooldridge, Inc.

Subject: African Safari Adventure

Toastmaster: J. R. MCKINNEY, Vice President, Christian, Schwarzenberg and Gaede Co.

Program Chairman: MICHAEL A. FANELLI, Vice President, Hoist Equipment Co.

Members desiring to do so will join in a conducted tour of the Engineering Center.

All members, their ladies, students, and guests are cordially invited to attend this dinner. Per plate, $5.00.

FRIDAY MORNING

MAY 8

City Planning Division

9:30 a.m. Whitehall Room

Presiding: J. Cal Callahan, Chairman, Executive Committee

A Preview of the Final Report of Metro

JAMES A. NORTON, Director, Cleveland Metropolitan Services Commission.

Hydraulics Division

9:30 a.m. Rose Room

Sponsored by Committee on Sedimentation

Presiding: Harold M. Martin, Member, Exec. Committee, and Fred H. Larson, Past-Chairman, Sedimentation Committee

9:30 **The Functions and Objectives of the Sedimentation Subcommittee of the Inter-Agency Committee on Water Resources**

WARREN T. MURPHY, Director, Div. of Flood Prevention and River Basin Programs, U. S. Forest Service, Washington, D. C.

10:00 **Observations of Flood Flow Effects on Channel Boundaries**

DONALD A. PARSONS, Hydraulic Engr., Agricultural Research Service, U. S. Dept. of Agriculture, East Aurora, N. Y.

10:30 **The New ARS Sedimentation Research Laboratory, Oxford, Miss.—Problems and Objectives**

RUSSELL WOODBURN, Project Supervisor, Agricultural Research Service, U. S. Dept. of Agriculture, Univ. of Mississippi.

DISTRICT 9 CONFERENCE

Friday, May 8

9:30 a.m., 1:00 p.m. Whitehall Room

STUDENT CONFERENCE

10:00 a.m. Empire Room

10:00 **Education Beyond the Undergraduate Level**

A panel discussion by men in construction, design, and civil service on the subject of formal and informal education after graduation.

11:00 **Seismology of Little America**

HENRY J. BIRKENHAUER, S.J., Seismologist at John Carroll Univ.

FRIDAY AFTERNOON

MAY 8

FIELD TRIP OF CITY PLANNING DIVISION

Friday, May 8 **2:30 p.m.**

Trip to inspect Cleveland's Rapid Transit System.

FIELD TRIP TO LEWIS RESEARCH CENTER

1:00 p.m. **Friday, May 8**

Inspection Trip to Lewis Research Center, operated by the National Aeronautics and Space Administration

(Only U. S. citizens will be permitted to make this field trip.)

All members, ladies, guests and friends of ASCE are cordially invited.

Bus transportation will be furnished both ways. Fee $1.00 per person.

WOMEN'S PROGRAM

Monday, May 4

Luncheon at Women's City Club

Speaker: MRS. TRYGVE W. HOFF

Chairman: MRS. FRANK E. KRAUSS, President, ASCE Wives.

Attendance limited to 100.

Tuesday, May 5

Luncheon at Westwood Country Club

Speaker: MISS ELIZABETH KARDOS, Fashion Personalizer.

Chairman: MRS. JAMES C. F. SHAFER

Busses will be provided.
Per person, $5.00.

Wednesday, May 6

Open. Maps will be provided for visiting points of interest and shopping areas.

Thursday, May 7

"Dutch Treat" Luncheon at Captain Frank's on East 9th Street Pier, followed by boat ride in Port of Cleveland Inner Harbor and up the Industrial Cuyahoga River. Time to be announced later. Busses will be provided. Per person, $1.00.

CLEVELAND CONVENTION COMMITTEE

Wendell R. Swatosh, *General Chairman*

General Co-Chairmen
Alfred D. Yanda, Homer T. Borton

General Committee
Mauno Bockland, Alfred D. Yanda, C. Merrill Barber; James M. Hicks, *Secretary*

Public Relations Committee
E. C. Mardorf, *Chairman*
C. Andy Pretzer

Attendance Promotion Committee
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G. Brooks Earnest, *Chairman*
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Excursion Committee
M. Friedman, *Chairman*
W. Donaldson

Women's Activity Committee
Mrs. Alfred D. Yanda, *Chairman*
Mrs. James C. F. Shafer, *Vice Chairman*
Mrs. William B. Auping, Mrs. William Dyer, Mrs. G. Brooks Earnest, Mrs. John B. Scalzi

SOCIETY NEWS

ASCE Los Angeles Convention Reviewed

Los Angeles, the most recent meeting place for an ASCE Convention, was a highly logical location for such an affair. As in the past, Los Angeles will continue in the future to look to the civil engineer for the solution of its many problems.

A variety of these engineering problems were discussed at the week-long meeting, held at the Statler Hilton Hotel in downtown Los Angeles, February 9-13. Among the subjects covered were the development of the Los Angeles Airport, the Los Angeles flood control problem, subsidence problems, freeways and their effect on urban planning, the control of atmospheric pollution, and breakwaters. The sessions were marked by unusually large attendance and by lively and interesting informal discussion of the papers.

Jet Age Problems

Engineers attending the Convention, which started shortly after the first jet passenger plane landed in Los Angeles from the East Coast, were told that the noise of jet aircraft which has been a problem in New York and other cities planning airport facilities for the new jet age, is not expected to be troublesome at the Los Angeles International Airport. Donald E. Willcox, project manager of the joint venture for the Los Angeles International Airport, told a Convention session that Los Angeles has been exposed to the jet problem for years, so the activity of jet aircraft around the new terminal facilities will not bring many surprises to the people of the Los Angeles area. Much thought has been given to future planning at the airport, Mr. Willcox said, and he added that practical and good design in an atmosphere of full participation by all agencies and operators will result in a first-rate airport.

Urban Renewal Stressed

Business and industry—not government—should supply most of the local leadership required to make urban renewal a success in any city, an executive of Sears, Roebuck and Co., told a session sponsored by the City Planning Division. Pointing out that the company has its own urban renewal program because of its responsibility as a corporate citizen, Harry N. Osgood, director of Sears' urban programs, said that any major renewal effort can succeed only if citizens and leaders contribute their time and effort to the program. He stated that Sears has had a national urban renewal program for three years. The program consists of informing the members of the Sears organization of the complex problems involved in urban renewal and city planning and indicating how they can most effectively contribute to the solution of problems in their own community.

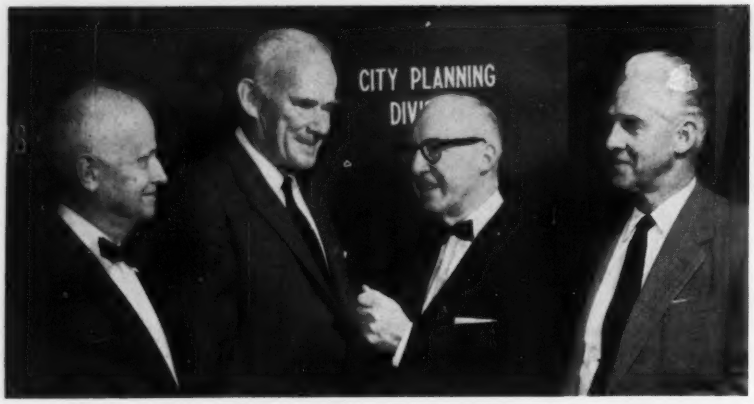
In discussing the Los Angeles urban renewal plan, William H. Claire, assistant executive director of the Community Redevelopment Agency, stated that the work ahead in urban renewal for the City of Los Angeles cannot be accomplished by redevelopment alone. According to Mr. Claire, the urban renewal work in Los Angeles will be accomplished sooner at less cost and sound benefits will be realized at an earlier date if: (1) the public is shown the sociological and economic necessity for urban renewal, (2) state redevelopment legislation is simplified and improved, (3) federal funds for urban renewal are available in sufficient time and amounts, (4) adequate measures are developed for the local share of net project costs, and (5) strong support comes from the people of the community.

Missile Facilities

Maj. William L. Barnes, special assistant, Los Angeles Engineer District, Corps of Engineers, predicted that, in the foreseeable future, missile facilities now contemplated may become so standardized as to be routine for installation all over the world. He stated that facilities for the Atlas and Thor missiles are similar in construction, with the Thor somewhat lighter. The launching structures for the Atlas are examples of the heavy construction involved since each contains approximately 4,000 cu yd of concrete. The Thor facility was used early in December 1958 when the first Thor missile was launched on the new Pacific Missile Range from Vandenberg Air Force Base. The Titan facility now being constructed at the Vandenberg base has the same basic components as the Atlas and Thor facilities, but is being constructed almost completely underground.

"Industry and Education" was the topic of a luncheon address presented by Admiral Charles F. Horne, vice-president, Convair Corp. Seated at left is ASCE President Francis S. Friel.

Lee A. DuBridge, president of California Institute of Technology, addressed the Awards Luncheon on "The University's Role in Engineering Research." Seated is Samuel B. Morris, the Society's Vice-President from Zone IV.



Reception and dinner marked the City Planning Division's 35th anniversary celebration during the Los Angeles Covention. Harold M. Lewis, consulting engineer and city planner was featured speaker. Seen here, in usual order, are Mr. Lewis; L. S. Storrs, director of planning for San Marino, Calif., and president of the Southern California Planning Congress, which co-sponsored the dinner; ASCE President Francis S. Friel; and Everett B. Mansur, vice-chairman of the Division's executive committee and past president of the Southern California Planning Congress. Guests of honor included prominent planners.

Engineers and unions were up for discussion at a Conditions of Practice session. Speaking at this meeting were (left to right) Jack Y. Long, partner, J. Y. Long Co., Engineers; William W. Moore, partner, Dames and Moore; and Arnold Olitt, partner, Woodward, Clyde, Sherard and Associates.

Engineers attending a session sponsored by the Hydraulics and Waterways and Harbors Divisions heard a paper presented by Harold E. Hedger, retired chief engineer of the Los Angeles County Flood Control District. Mr. Hedger's topic was water conservation as a partner of flood control.

Erosion Control

In discussing erosion control on southeastern Arizona's San Simon Creek before a Hydraulics Division session, G. H. Lipscomb, state agricultural engineer of the U. S. Bureau of Land Management, stated that erosion control, as viewed by the Bureau, includes not only the stabilization of soils for protection against water and wind erosion, but also the equally important function of rehabilitation and protection of the areas already crippled by erosion. He explained that the primary objective of control on the San Simon is the conservation of soil and moisture to such an extent that watershed lands will produce the maximum desirable vegetation and be subject to minimum soil losses. This can be accomplished, Mr. Lipscomb continued, through the stabilization and regrading of existing gullies and channels by mechanical structural installations together with artificial and natural revegetation of the rehabilitated area and adjacent range.

Watershed treatment projects in the San Gabriel Mountains of Los Angeles County differ possibly from those of other areas in that their main objectives are (1) to protect the inhabitants and property near the watersheds from flood damage, (2) to lessen the financial burden of maintaining a large number of debris-retaining and flood-regulating structures that have been constructed as part of the flood control program, and (3) to conserve water for use in the developed area below. In another Hydraulics Division paper, William R. Farrell, civil engineer for the Los Angeles County Flood Control District, described the various methods used in Los Angeles County to achieve these ends.

Atmospheric Control

Engineers attending a session of the Sanitary Engineering Division were told by a California Department of Public Health official that the denser the population, the greater the air pollution or smog will be. Communities not now experiencing air pollution will be faced with the problem as they become more densely populated, John A. Maga, chief of the State Bureau of Air Sanitation, Berkeley, warned the group. The most serious air pollution problem will be found in the largest communities since the quantity of pollutants emitted into the atmosphere is directly related to the size of the community, with accompanying industrial and commercial development and motor vehicle use. Mr. Maga also stated that it is obvious that areas where air pollution is already a problem will have even more serious and more frequent attacks unless effective control measures are undertaken.

In continuing the discussion of smog in the Los Angeles area, W. L. Faith, of the Air Pollution Foundation, San Marino, Calif. said that California is currently in the midst of important advances in the elimination of smog by controlling the irritating elements in automobile exhaust fumes. The greatest efforts, in the field of automobile exhaust control, are still ahead of us. Though a great deal can be learned by engineering development studies and extensive tests of today's crude after-burners, Mr. Faith said, it would be a mistake to believe that they will be the ultimate answer to the automobile exhaust problem.

Sewage Waste Water

Sewage waste water was the topic of three other papers presented at Sanitary Engineering Division sessions. According to F. R. Bowerman, assistant chief engineer of the Los Angeles County Sanitation District, the reclamation of waste water in Los Angeles appears to be the only feasible means of augmenting existing water supplies until additional imported supplies can be made available in Southern California (in about 1975). It is estimated that by 1965 water shortages will develop in Los Angeles County unless waste water reclamation is developed as a significant source of water. Mr. Bowerman said that water reclaimed would be of satisfactory quality and so situated as to be available for groundwater recharge for industrial, recreational, or agricultural purposes.

Continuing along the lines of using

sewage waste water for recreational purposes, Prof. Robert C. Merz, of the University of Southern California, stated that the expanding use of waste water in the development and maintenance of golf courses in the southwestern part of the United States is making possible the development of recreational facilities. In California, Nevada, Texas, Arizona, and New Mexico, he said, installations for the use of waste water for this and other recreational purposes have been provided. He stated that sanitary engineering processes make it possible to produce a dependable sewage effluent for golf course use with a minimum of public health hazard and esthetic problems.

Continuing the discussion of the use of waste water Ralph Stone, consulting engineer of Beverly Hills, stated that reclaimed sewage waste water is being successfully employed in San Diego and other areas for grass, shrub and crop irrigation, decorative lakes, certain industrial uses, and some groundwater recharge. He stated that while there are legal aspects to be considered, they are not insurmountable. Mr. Stone also noted that waste water reclamation is competitive with other saleable sources of supply.

Highway-City Planning Sessions

A paper prepared jointly by J. W. Vickery, deputy state highway engineer, and M. H. West, principal highway engineer, of the California State Division of Highways, stated that it is the conclusion of the Department of Public Works that the California Freeway system is economically justified and is financially feasible within the framework of present highway user finances within a reasonable period of years. The system will serve directly or closely all urban centers estimated to reach a population of 5,000 or more by 1980, the paper continued. Where the Freeway serves directly, it will absorb a large part of all rural traffic flow and will relieve for local use the most congested city streets by removing the longer-distance through traffic. It was also stated that the system should reduce highway fatalities by 60 to 75 percent for the traffic using it, when it is developed to full freeway standards.

Taking a different view of the new highway program, George W. Anderson, executive vice-president of the American Transit Association, New York, stated that contrary to common opinion, public transportation is still very much alive. He continued that the record multi-billion-dollar construction program which this nation has plunged into is definitely not going to solve the urban traffic congestion problem. If anything, he thinks, the new roads now being built will seriously aggravate the problem by pouring more and more vehicles into areas where there simply is not sufficient physical space to accommodate them. He stated that millions of Americans are spending disproportionate sums for automobile transportation when more efficient and less costly transportation is, or could be, available. Like other competitive businesses, transit management in this day and age needs the freedom to establish and adjust fares in accordance with sound business practices. Mr. Anderson concluded by stating that repeal of outmoded and discriminatory taxes, another relic of the early street car age, is long overdue even though significant progress in this direction has been recorded in some areas in recent years.

Structural Sessions

Ultimate strength design was the subject of two papers reported before a combined session of the Structural and Engineering Mechanics Divisions. Phil M. Ferguson, professor of civil engineering at the University of Texas, stated that ultimate strength design of reinforced concrete came of age with its inclusion in the ACI Building Code in 1956. Although much remains to be done, he said, in developing simpler design procedures through tables and charts, ultimate strength design is now on a sound basis and design is actually simpler than by working stress methods. The general adoption of ultimate design accompanied by closer controls on concrete quality will, in Professor Ferguson's opinion, definitely improve design and in the long run save on materials.

In further developing the ultimate strength theory R. A. Shoolbred, regional structural engineer for the Portland Cement Association, presented a few of the outstanding applications of ultimate strength design in this country. Adopted about three years ago by the ACI as part of its building code for reinforced concrete, ultimate strength theory has been used in the design of buildings all over the country and is in the codes of many of our larger cities. Mr. Shoolbred cited an example of a rigid frame. Using ultimate strength design as compared to straightline theory, the savings in the rigid frame amounted to approximately 15 percent of the concrete and 12-15 percent of the reinforcing steel. There is much to look forward to in the Ultimate Strength Theory as more engineers become familiar with the design techniques and advantages of the method.

Samuel B. Nelson, assistant manager of the City Department of Water and Power in Los Angeles, addresses an Irrigation and Drainage Division session on the water supply problems facing Los Angeles.

A highlight of the Student Awards Luncheon was the surprise presentation of the Distinguished Civilian Service Medal to Harold E. Hedger, retired chief engineer of the Los Angeles County Flood Control District. At the presentation ceremonies were, in usual order, Col. C. T. Newton, district engineer, U. S. Army Engineer District, Los Angeles; Mr. Hedger; Governor George D. Clyde of Utah, member of ASCE and featured luncheon speaker; ASCE President Francis S. Friel; and Brig. Gen. John L. Person, assistant chief of engineers for civil works (representing Secretary of the Army William M. Brucker).

A highlight of the Los Angeles Convention was the Awards Luncheon at which research awards were presented to four members of the Society. Shown at the speakers' table, in usual order, are ASCE President Francis S. Friel; Arthur T. Ippen, chairman of the ASCE Committee on Research; and the four award winners—John W. Clark of the Alcoa Research Laboratory; Hans A. Einstein and Warren J. Kaufman, of the University of California; and Ivan Viest, of the AASHO Road Test.

Soil Mechanics Sessions

Earthquakes and subsidence occupied much of the time spent in Soil Mechanics and Foundations Division sessions. Tentative conclusions on the Pacific Palisades landslides were revealed by James P. Gould, of the New York consulting firm of Moran-Proctor Mueser and Rutledge. Since the study conducted by his firm will not be completed until June, Mr. Gould confined his paper to the methods used in the investigation and technical information obtained to date. A tentative conclusion reached was that historical evaluation suggests that slide activity commences with concentrated rainfall over a short period and continues for several years even under average or deficient rainfall. It indicates, Mr. Gould continued, that movements will recur until imbalance of body forces is reduced.

Another speaker drew an analogy between floods and landslides and said that, as in the case of flood control, there should be federal assistance in control of landslides in the Pacific Palisades. R. Robinson Rowe, principal bridge engineer of the California Division of Highways, stated that when appeals were made to a federal agency for assistance in control of the Palisades landslides, according to press reports, petitioners were advised that such assistance was not provided for in existing laws. Like floods, Mr. Rowe declared, landslides may threaten the property of many people who cannot act individually. Similarly they may be caused by physiographic changes on the highlands beyond the control of proprietors of lower lands. Like flood control, landslide control may require the acquisition and abandonment of some property in order to insure the safety of more. Two cities, Santa Monica and Los Angeles, as well as the county and the state have made independent investigations of slides and slide hazards within their respective jurisdictions. The cooperative program resulted in the employment of a New York consulting engineering firm with two successive contracts to study the problem.

Irrigation and Drainage Sessions

Some revealing conclusions on how the future growth of Southern California depends on the increased supply of imported water were presented by Harvey O. Banks, director of California's Department of Water Resources, at a session of the Irrigation and Drainage Division. Mr. Banks stated that the phenomenal growth of population and industry in recent years in Southern California may be expected to continue only if provision is made for an adequate supply of water. Also, more than California water will be required to sustain the economic development of the Southern California area after 1970, he stated. By that date, only eleven years away, the water needs of expanding population and industry will have fully utilized the entire claimed rights of the Metropolitan Water District of Southern California to Colorado River water.

Engineers were told that the Colorado River Aqueduct of the Metropolitan Water District will soon be able to deliver double the amount of water it is now bringing to the coastal plain of Southern California. Robert B. Diemer, federal manager and chief engineer of the District, pointed out that since 1952, the District has been engaged in carrying forward a huge aqueduct expansion program. In discussing additional needs for the Southern California area, Mr. Diemer stated that although investigations of methods of desalting ocean water are being made by the government and private agencies, no definite information is available at this time as to the cost. However, it is well established that it will cost much more than importing water from the north.

Waterways and Harbors Sessions

In a paper on the breakwater in Crescent City, California, John A. Deignen, chief, Engineering Division, U. S. Army Engineer District, San Francisco, described the design criteria and some of the methods and problems involved in building the structure. Tetrapods used for construction consisted of an integrally cast four-arm concrete block, any two arms of which form an angle equal to that formed by any other two arms. The arms are shaped as truncated cones and are joined to a central core. These tetrapods, he said, have proved a satisfactory substitute for armor stone in the construction of the Crescent City breakwater. He recommended that engineers concerned with further construction and repair of breakwaters on the West Coast should consider the cost of tetrapods or other fabricated armour facings in relation to available quarried rock.

Engineers attending the same session of the Waterways and Harbors Division heard John A. Blume, president of John A. Blume & Associates of San Francisco, present a paper prepared by him and James M. Keith, project engineer for John A. Blume & Associates, on one of the most unique marine installations in the world, recently built off the coast of California. He described the design problems and construction techniques involved in creating a man-made island of sand, rock, and concrete tetrapods in the Pacific Ocean. This oil-production island with an open causeway connecting it to the shoreline represents a successful struggle against unprecedented storm risks.

Hydraulics and Waterways Sessions

In a paper before a joint session of the Hydraulics and Waterways and Harbors Divisions, H. E. Hedger, former chief engineer of the Los Angeles County

Flood Control District, discussed water conservation as a partner of flood control. Mr. Hedger stated that flood control district dams are so operated that they function in the achievement of three primary purposes. First, they are utilized for the extraction of debris, both lighter and heavier than water, from recurring storm precipitation. Secondly, they regulate storm waters to temporary reservoir storage and provide for their release at a reduced rate in relation to the inflow peak. Finally, the dams, wherever safety factors permit, conserve the flood waters to such an extent that clarified waters can be released at an appropriate rate to permit percolation in the stream channels and spreading ground. The most efficient method of water conservation in Los Angeles County has been found to be the recharge of groundwater basins, utilizing percolation in natural stream channels and on artificial spreading grounds and basins.

Waterways and Harbors—Power

The Long Beach Naval Shipyard, a major industrial facility, vital to the defense of the United States and the economy of the community, is sinking or subsiding at a rate of a foot a year. This alarming situation was the subject of a joint Waterways and Harbors-Power Division paper delivered by Charles H. Neal, Captain, Civil Engineer Corps, U. S. Navy. The shipyard overlies the Wilmington oil field which has been the most productive in California in the past twenty years, and detailed engineering and geological studies indicate that the subsidence of the Long Beach Naval Shipyard is caused by the removal of these fluids (oil, gas, and water). The work that has been done to date to counteract the effect of subsidence includes the construction of a reinforced concrete dike wall around the perimeter of the waterfront, the replacement of damaged utilities, installation of a steel sheetpiling cut-off wall, installation of seals at joints, construction of storm drainage pumping pits, and the provision of siphons. Projected work includes the installation of additional walls, the filling-in of certain areas that may be damaged by ground water, and modification of existing structures such as dry docks.

In the southern part of Los Angeles County there has developed over the past twenty years very extensive land subsidence accompanied by horizontal movement. This subsidence has progressed to an extent exceeding all early predictions, and it now presents a difficult, expensive, and complicated problem. Ray F. Berbower, assistant chief harbor engineer of the Long Beach Harbor Department, related some of the action that has been taken to counteract the effect of the subsidence. Dikes became necessary to protect the low areas from being flooded. Studies of the area are being made in an attempt to overcome the problem.

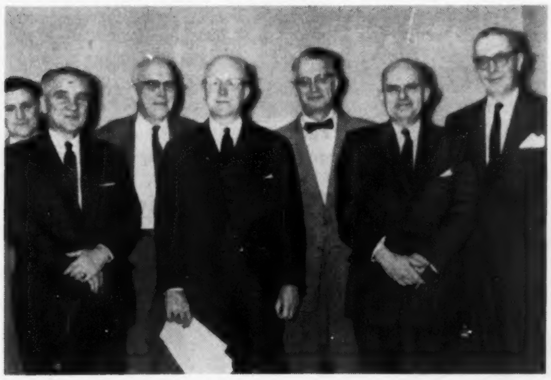
Luncheon Program

Francis S. Friel, President of ASCE, was featured speaker at Monday's Pace Setting Luncheon. Speaking on "How ASCE Activities Benefit Mankind," Mr. Friel noted that the disastrous flood which struck areas in the Middle West, principally Ohio, in January could have been prevented. He was confident that warnings about flood dangers in the area had been given by civil engineers. It would be revealing to learn, he added, why such warnings were not heeded. Melting snows and rains caused the floods that inundated cities, brought many deaths, and resulted in billions of dollars in destruction. Mr. Friel stated that what may not be realized is that floods similar to the Ohio disaster are being prevented in many parts of the country because of the foresight of civil engineers, and the design and execution of proper flood control measures. The great flood control work on the Mississippi River is a prime example of civil engineers' work, added Mr. Friel. "We in civil engineering," he said, "are dedicated to serving mankind and unless we do all in our power to bring about improvements in public works, I'm afraid we are being derelict in our professional duty."

At the Awards Luncheon on Tuesday the Society's 1958 Research Awards were presented to John W. Clark, Hans A. Einstein, Warren J. Kaufman, and Ivan Viest. The fifth winner, Ray Mindlin, will receive his award at a future Society function.

At the Awards Luncheon, Dr. Lee A. Dubridge, president of the California Institute of Technology, addressed the group on the university's role in engineering research. He stated that it is a rather shocking fact that at the beginning of the first school year after the dawn of the space age, in spite of all the enormous excitement that event caused and the enormous amount of talk about science and engineering, engineering enrollment in the freshman classes of the nation's engineering colleges actually declined by about 11 percent over the previous year. He suggested that until this tide is somehow reversed and young people start flocking into the field again, attracted not only by the immediate practical

Shown at a session of the Publications Committee are (left to right): Charles W. Britzius; Tilton E. Shelburne; Harold T. Larsen, Manager of Technical Publications; Howard F. Peckworth, chairman; E. Leland Durkee; Fred H. Rhodes; and Philip C. Rutledge, vice chairman.



The wives had a good time at Los Angeles, too. Some of them are shown in the Ladies Hospitality Room, where coffee was an every-day feature. Mrs. Irvan F. Mendenhall and Mrs. Marvin J. Kudroff and their Ladies Activities Committee planned an enjoyable program.

problems but by the exciting research areas, filled with possibilities for future achievement, the engineering research fields will not prosper as they should and will not attract the funds they should. To bring the challenge of civil engineering to young people and to make them realize its almost unlimited potential is, he told the group, "a task worthy of your distinguished society."

At the Student Awards Luncheon on the concluding day of the Convention Governor George D. Clyde of Utah suggested that the nation has consigned too much authority to lawyers in handling the affairs of government. Governor Clyde, a civil engineer and long-time member of the Society, remarked that the dominant figures of the age of the atom are scientists and engineers and that they are leading the way to the exploration and conquest of the mysteries of the universe. It is essential, he declared, that these same men have a share in the shaping of our society and our course in government. In his opinion legal training and the understanding of the basic concept of law are most helpful to holders of executive office in government who are charged with the administration of the laws of the land. However, Governor Clyde declared that every branch of our government should also represent a cross section of our population and, particularly, the leadership in the fields that most critically affect the overall advancement of our economy and civilization. The way of the future is not to be found in academic or industrial activity but in a proper balance of all worthwhile fields of endeavor, he concluded.

Conditions of Practice

An innovation at the Los Angeles Convention was the holding of sessions planned by the Department of Conditions of Practice at times when no other programs were scheduled. This insured maximum participation by all members attending the Convention. At one session sponsored by the Committee on Employment Conditions, William W. Moore, partner in Dames and Moore, noted that there is no simple or conclusive answer to the question of unionization for engineers. Engineers (both employers and employees) have the same economic problems and desires as other members of the business community. He said that pressures for unionization come from at least three sources: One is from engineers who want more than they currently receive, another is from union organizations which want larger membership and more dues, and another is from union organizations which want wider and stronger control over an industry—in our case the construction industry. Mr. Moore believes the engineering profession must arrange its own affairs and conditions of practice so that both employers and employees are satisfactorily compensated—both in money and in professional recognition. All engineers, he continued, should consider very carefully the nature of any organization with which they become affiliated. Factors to be weighed should include the degree of member control in the organization, and its policies concerning ethical and professional responsibilities and attitudes.

Arnold Olitt, partner in the firm of Woodward, Clyde, Sherard & Associates, in describing his firm's association with unions, stated that the effect of unionization on employees is to better their working conditions, raise the wage scale, protect employees from interference from other unions, and to help them understand the problems of management in its dealings with employees. There are certain disadvantages also. Most important is that the recommended minimum wage is usually considered the maximum. In addition, management is not so lenient with respect to sick leaves, vacations, and retention of employees during slack periods. There are certain benefits to management via dealings with unionized employees. First, he stated, various management firms are forced to band together and therefore get to know the principals of other firms in the same field and become acquainted with their mode of operation. Secondly, they also are protected from interference by other unions. There are also disadvantages to employers. There is a great deal of additional paper work involved such as check-off sheets for union employees authorizing pay-roll deductions for union dues, notification to the union of employment of eligible employees, and termination notification. Of course there is also the threat of a strike during contract negotiations. Mr. Olitt noted that since his firm has had only two and a half years of experience, it is still difficult to state positively how unionization has worked out. In general, however, his firm's dealings with the union have been amicable.

Industry and Schools

Close association between industry and the schools is essential in preparing America's youth to meet the ever-changing and complex demands of our technological growth, Robert E. Kelly told a session sponsored by the Committee on Engineering Education. Mr. Kelly, associate superintendent of the Los Angeles City School System, stated that a committee was formed to facilitate and direct expansion of the joint efforts of industry and education in the city. This has developed into a program which includes demonstration lectures, summer-work fellowships for teachers, and teacher workshops.

In answering the question "What does industry expect from the schools?" Ford Dickerhoff, director of personnel for the Hughes Aircraft Co., stated that engineering enrollment dropped off last year while the engineering need continues to go up. However, he stated that emphasis should be on quality rather than quantity although quantity is also important. A necessary factor in this regard, Mr. Dickerhoff stated, is the proper motivation of children, parents, educators, to see that the child is properly educated and prepared for an exciting career in the field of science or engineering.

The final Conditions of Practice program was sponsored by the Committee on Engineers in Public Practice. Robert D. Gray, president of the California State Personnel Board, told the ASCE that the challenge for the future is to develop incentives and rewards for engineers and others in state Civil Service and that the best way to do it is through appropriate legislation. The first need, as he sees it,

Among the many schools represented at the convention and in the Student Paper Contest was the University of Arizona, the largest contingent. Seen in the middle row, second from left, is Dr. Gene Nordby, chairman of the Department. Continuing left to right are Otis D. Gouty, assistant to the Secretary; Quentin M. Mees, Faculty Adviser; and Don Cherry, Student Chapter president.

is to develop a philosophy that the objective of state civil service should be to encourage the selection and development of individuals so that their abilities, knowledge, and skills can be used to the mutual advantage of society as a whole.

Confronting the civil engineer in civil service are such problems as salary, selection of personnel, security, and retirement stated Jean Vincenz, director of public works for San Diego County. Engineers at the supervisory level and in the lower echelons have problems that in many cases are not similar. It is of particular importance that engineers in the higher echelons recognize not only their own problems but also those of subordinate engineers and do all they can to assist in the solution of these problems. Mr. Vincenz urged engineers in public practice to support their own employee organizations and to secure proper representation for their engineers in the policy making of such organizations.

Student Activities

Student participation in the Convention included a student paper contest. In a contest for four guest schools outside the Pacific Southwest Conference, the winner was Henry C. Moorehead, Jr., from the University of New Mexico, who presented a paper on "Calcium Chloride in Concrete." In the contest for schools in the Pacific Southwest Conference the winner was Dan Urriola, of the University of Nevada, whose subject was "Plan Badajoz, Spain's Irrigation Project." The winner's trophy and check were presented by Brooks Earnest, president of Fenn College. On Friday afternoon the students took a bus tour to the California Institute of Technology, where they heard Henry J. Brunnier, Honorary Member of ASCE, speak on "The Joys of Engineering." A tour of the impressive engineering facilities and laboratories on the Caltech campus was also enjoyed.

In addition to some 150 papers available, the Convention Program featured field trips to Freeway construction projects, the Los Angeles Harbor, and the Hyperion outfall sewer. Many social events, including an "ice-breaker" cocktail party, a smoker for the men and a puffer for the ladies, a dinner at Disneyland, and the traditional dinner dance were enjoyed by the engineers and their wives. There was a gratifying attendance of 1,600 to take in the varied events.

Perhaps the only common factor in all successful conventions is a maze of details and a crew of ambitious, enthusiastic workers. Trent R. Dames, general chairman, led a team of cooperative Los Angeles Section members in assuring the success of the Convention. The Technical Program Committee, headed by George E. Brandow, was responsible for the wide range of that program. All who attended the Convention owe a sincere "thanks" to the Los Angeles Sections for making their visit to the Convention so informative and enjoyable.

ASCE Board Meets in Los Angeles

The Board of Direction, meeting in conjunction with the Los Angeles Convention, took steps to create a coordinating committee on transportation, recommend an extension of registration among engineers in public service, support a study of pay systems of the federal government, and promulgate a statement of Society policy on surveying and mapping.

One of the important actions of the Board of Direction was the creation of a **Coordinating Committee on Transportation** to report directly to the Committee on Division Activities with this stated purpose: (*a*) encourage more exchange and contact among the several Technical Divisions interested in transportation, (*b*) act as a focal point for initiating studies and disseminating information on broad transportation policies, (*c*) make a detailed study of existing Technical Division activities and recommend changes to fill voids and eliminate overlap, and (*d*) study contacts with organizations interested in broad transportation policies but not directly connected with the Society. Representatives on the new committee are to be appointed from the Air Transport, City Planning, Highway, Pipeline, and Waterways and Harbors divisions.

The Board of Direction authorized official support by the Society of the **nomination of Sylvanus Thayer to the Hall of Fame, 1960.** Sylvanus Thayer has been called the "Father of Technology in the United States." As superintendent of the U. S. Military Academy at West Point from 1817 to 1833, Mr. Thayer played a leading role in the development of that all-important institution. He is credited with having upgraded the curricula of two of the leading universities in the United States—Harvard in the North and the University of Virginia in the South—and with aiding in the establishment of engineering courses at Rensselaer. The Thayer School of Engineering at Dartmouth College is named in his honor.

The Board voted to approve a recommendation of the Committee on Registration of Engineers "that the Society adopt the policy that all persons holding positions in public service, whose duties involve responsibility for engineering design, construction or other engineering services, should be **registered professional engineers.**" This new policy is to be transmitted to Engineers Joint Council with a recommendation that that organization take appropriate steps to implement the policy at federal level, and request constituent societies to implement the policy at state and local level. It was also recommended that the cooperation of EJC, the National Society of Professional Engineers and other appropriate organizations be sought in implementation of the program.

On recommendation of the **Committee on Engineers in Public Practice** the board voted "to approve, endorse and support the creation by Congress of a joint commission to make a comprehensive, all-inclusive study of the pay systems of all three branches of the federal government, in substantial accord with the 'message from the President of the United States' relative to the compensation of employees of the federal government."

The Board of Direction adopted as Society policy the statement: "The American Society of Civil Engineers, on the basis of thorough studies carried out by a **Task Committee on the Status of Surveying and Mapping,** declares that the following four major categories in the field of activity commonly designated as surveying and mapping are a part of the civil engineering profession: land surveying, engineering surveying, geodetic surveying, and cartographic surveying.

This is in line with the report of the Task Committee stated briefly in Civil Engineering for November 1958, page 92.

The Society declares that professional and technical positions in the foregoing categories should be classified according to a chart, which is part of the task committee's final report and is similar to one printed in Civil Engineering for March 1957, page 73. Recommendations of the task committee concerning Civil Engineering curricula are referred to the Committee on Engineering Education, with other specific items referred to the Committees on Registration of Engineers, Membership Qualifications, and Professional Practice for study and report to the board.

The board selected the Atlanta-Biltmore Hotel at Atlanta for a Feb. 25-March 1, 1963, Convention of the Society and the Schroeder Hotel at Milwaukee for a May 20-24, 1963, Convention.

ASCE Nears Half-Way Point in UEC Campaign

ASCE Giving Passes $372,557 as of February 6

Local Section	Quota	Amount Pledged	% Quota
ZONE 1	$197,300	$112,242	57
District 1	**133,300**	**82,279**	**62**
Brazil	2,100	70	3
Metropolitan	119,200	79,159	66
Panama	1,300	90	7
Puerto Rico	3,100	1,645	53
Rep. Colombia	2,400	185	8
Venezula	5,200	1,130	22
District 2	**43,400**	**16,135**	**37**
Connecticut	11,000	4,083	37
Maine	4,700	200	4
Massachusetts	23,000	9,084	40
New Hampshire	1,800	438	25
Rhode Island	2,900	2,330	80
District 3	**20,600**	**11,328**	**55**
Buffalo	4,400	2,005	45
Ithaca	2,400	1,844	77*
Mohawk-Hudson	7,500	2,893	39
Rochester	1,900	1,919	101
Syracuse	4,400	2,667	60
ZONE II	169,700	77,465	46
District 4	**34,000**	**34,809**	**104**
Delaware	4,100	3,224	79
Lehigh Valley	4,200	5,562	134
Philadelphia	20,000	21,628	108
Central Pa.	5,700	4,395	78
District 5	**27,000**	**5,472**	**21**
Nat'l Capital	27,000	5,472	21
District 6	**49,000**	**15,062**	**31**
Maryland	15,000	5,616	37
Pittsburgh	17,000	4,604	27
Virginia	18,300	4,286	32
West Virginia	3,700	556	15
District 10	**59,700**	**19,622**	**33**
Alabama	8,900	2,184	24
Florida	11,500	590	5
Georgia	11,000	6,931	63
Miami	5,200	340	5
Nashville	2,700	2,740	101
N. Carolina	6,300	2,856	45
S. Carolina	4,900	1,492	30
Tenn. Valley	9,200	2,489	27
ZONE III	202,200	87,861	43
District 7	**39,900**	**7,638**	**19**
Duluth	1,500		
Michigan	18,000	1,059	6
Northwestern	8,000	1,420	18
Wisconsin	10,700	5,159	48
S. Dakota	1,700		
District 8	**37,100**	**21,639**	**58**
Cent. Ill.	6,500	2,655	41
Illinois	29,000	18,984	65
Tri-City	1,600		
District 9	**45,700**	**26,419**	**57**
Akron	3,100	1,065	34
Central Ohio	5,100	363	7
Cincinnati	4,700	6,482	117
Cleveland	9,300	2,180	23
Dayton	3,300	1,588	48
Indiana	11,000	7,975	72
Kentucky	6,100	6,516	106
Toledo	3,100	250	8
District 14	**31,500**	**11,358**	**36**
Mid-Missouri	3,500	735	21
Mid-South	11,000	4,069	37
Oklahoma	6,900	1,870	27
St. Louis	10,100	4,684	46
District 16	**48,000**	**18,307**	**38**
Colorado	13,900	2,388	17
Iowa	5,900	2,925	50
Kansas City	12,000	8,538	71
Kansas	7,600	2,712	36
Nebraska	6,300	1,724	27
Wyoming	2,300	20	1
ZONE IV	230,800	94,989	41
District 11	**132,600**	**50,243**	**38**
Arizona	5,000	1,635	33
Hawaii	6,300	7,282	116
Intermountain	4,700	892	19
Los Angeles	50,200	14,455	29
Sacramento	16,300	488	3
San Diego	6,000	2,111	35
San Francisco	44,100	23,380	53
District 12	**40,400**	**15,620**	**39**
Alaska	2,200	565	26
Columbia	2,200	2,473	113
Montana	3,300	430	13
Oregon	10,900	2,080	20
Seattle	12,200	4,566	38
S. Idaho	2,300	1,045	45
Spokane	3,100	1,418	45
Tacoma	4,200	3,043	73
District 15	**57,800**	**26,626**	**46**
Louisiana	13,000	2,593	20
Mexico	1,400		
New Mexico	4,000	605	16
Texas	39,400	23,428	59
	†$800,000	$372,557	47

* Quota exceeded later.

† The $800,000 ASCE quota is apportioned according to assigned Local Section membership.

The news about the Member Gifts Campaign for the United Engineering Center continues to be encouraging without giving grounds for complacency. By the time this issue reaches members ASCE will doubtless have passed the half-way mark toward its goal of $800,000. As of February 13, the tally stood at $383,550, or 48 percent of the Society's assigned share. This amount was pledged by only 5,432 members. With over 42,000 currently on the Society's rolls, no computer is needed to determine that the majority of our members are still to be heard from. And it bears repeating that the Member Gifts Committee is hoping to hear soon!

District 4 (Lehigh Valley area—E. L. Durkee Director) has the distinction of being the first in the Society to exceed its quota. On the honor roll, too, are ten Local Sections. In the order of meeting their quotas they are Kentucky, Lehigh Valley, Nashville, Cincinnati, Columbia, Philadelphia, Hawaii, Rochester, Ithaca, and Southern Idaho. Several others are teetering on the verge. Some of the Sections have made substantial contributions to the UEC fund. These include Central Illinois, $200; Ithaca, $300; Jacksonville Branch of the Florida Section, $100; Metropolitan, $500; and Puerto Rico, $1,300.

Of the 433 sections in the five Founder Societies, 57 have exceeded their quotas, and an ambitious few have reached 200 percent. As of February 13, the five societies had attained 66 percent of their assigned quota of $3,000,000, with pledges totaling $1,997,804.

The industrial campaign is within sight of its $5,000,000 goal, with over 80 percent of its quota subscribed. To date the average industrial contribution has been $11,500 per subscriber, the average member contribution $49, and the average ASCE member contribution $70.

Help from the Students

One of the most heartening aspects of the campaign has been the close cooperation of engineering students. A letter from the Georgia Institute of Technology Student Chapter accompanying its check of $100 for the UEC fund notes

Georgia Institute of Technology Chapter contributes to UEC. Chapter President Ray Boyd (center, left) presents $100 check to John Bing, president of Georgia Section. At far left are Chapter Secretary Carlton Wilder and Jim Johns, editor of "In the Field." Prof. John Eichler, Faculty Adviser, is at far right.

that, "The contribution was made after thorough discussion of the subject by the members of the Student Chapter. The enthusiasm shown by the students during the discussion emphasized their realization of the immeasurable value that the Center will have for practicing engineers and members of future generations who aspire to the engineering profession."

In addition to Georgia Tech, ASCE Student Chapters that have sent contributions to the campaign are Manhattan College, $100; Newark College of Engineering, $50; University of Hawaii, $17; University of Kentucky, $75; and Drexel Institute of Technology, $25.

The Ladies Help, Too

Very substantial help is also being received from ladies' auxiliary groups. For instance, seven gifts totaling $3,515 have come through the efforts of the Women's Auxiliary of AIME. The Women's Auxiliary of the Boston Section of AIEE has also been busy. The Society of Women Engineers, now associated in the Center project, is getting along with its campaign to raise $7,000.

The new and enlarged concept of service expected of the engineering profession in general and the engineering societies in particular makes essential the building of the new center as a base for these necessary activities.

Table 1. Quotas and Pledges to UEC as of February 13

Society	Goals in Dollars	No. of Subscribers	Amount Pledged	% of Goal	$ per Subscriber
ASCE	800,000	5,432	383,550	48	70
AIME	500,000	2,518	214,565	43	85
ASME	800,000	8,276	422,201	53	51
AIEE	900,000	17,444	673,810	75	39
AIChE	300,000	6,283	269,369	89	43
Others	....	314	34,307	..	110
Total	* 3,000,000	40,267	1,997,804	66	49
Industry	5,000,000	347	4,005,833	80	11,500
Grand Total	8,000,000	40,614	6,003,637	75	

* While the overall goal of member giving is shown as $3,000,000, the quotas accepted by the Societies total $3,300,000.

Flash! *Actual construction of the UEC moves a step nearer with the selection of the Turner Construction Company as general contractor.*

UEC HONOR ROLL

Kentucky
Lehigh Valley
Nashville
Cincinnati
Columbia
Philadelphia
Hawaii
Rochester
Ithaca
Southern Idaho

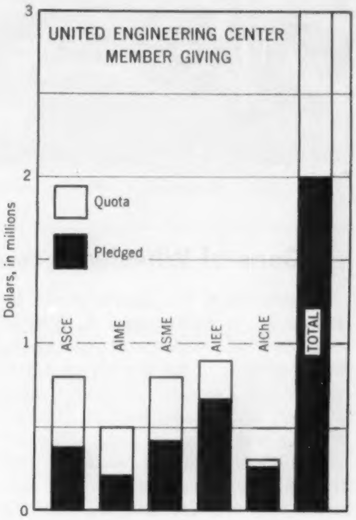


Fig. 1. Member giving for UEC as of February 13.

Change in Member Grades Requires Cleveland Action

The affirmative vote to change membership designations within ASCE must be canvassed at the next General Business Meeting of the Society—at Cleveland on May 6. A month later all those now designated Member, Associate Member, and Junior Member will automatically, and without other action or inquiry, become respectively Fellow, Member, or Associate Member.

The ballots were canvassed by the Board of Direction during the Los Angeles Convention. There was no general business meeting of ASCE there for a canvass by the members, as required by the Constitution.

Those who are now eligible for advancement to a higher grade of membership will be granted a grace period of one year in which they may apply for transfer under the present rules. After one year for those now in the Society, and after June 6, 1959, for all new applicants, the requirements for admission and transfer will be upgraded as outlined in the information sent with the ballot on the constitutional change and in Civil Engineering for November 1958, page 91.

Details of the change are being worked out by the headquarters staff. You are asked *not* to write ASCE concerning the mechanics of the change. Full information will be published in Civil Engineering as soon as it is available.

Hardy Cross, Honorary Member of ASCE, Dies

The Society has lost another distinguished member in the death of Hardy Cross, Hon. M. ASCE, at Virginia Beach, Va., on February 11. He was 74. An authority on structural engineering and former head of the civil engineering department at Yale University, Dr. Cross was internationally known as the originator of new methods of structural engineering analysis, particularly the moment-distribution method of computing stresses in rigid frames. The technique, known as the "Hardy Cross Method," is extensively used in design offices.

A 1902 graduate of Hampden-Sydney College, Dr. Cross had graduate degrees from Massachusetts Institute of Technology and Harvard University and several engineering doctorates. He was an engineer in the bridge department of the Missouri Pacific Railway from 1906 to 1910, and had taught at Brown University and the University of Illinois before joining the Yale faculty in 1937. He retired from Yale in 1951 with the rank of professor emeritus, and had lived at Virginia Beach since 1955.

A long-time member of ASCE, Dr. Cross was made Honorary Member in 1947. He held the Society's Norman Medal for a paper in Transactions. Other honors accorded him include the Wason Medal of the American Concrete Institute and the Lamme Medal of the American Society for Engineering Education. Recently he received the Gold Medal of the Institution of Structural Engineers of Great Britain for "outstanding contributions to the science and art of structural engineering."

British Atomic Power Plant Slated for Study at Nuclear Congress

New British atomic power plant under construction at Hunterston, Scotland, will be one of the featured subjects on the program of the 1959 Nuclear Congress, to be held in Cleveland, April 5-10. Photo shows part of the project, as seen from the top of a crane, with one of the two reactors in the center. Other Congress sessions will deal with use and disposal of radioactive materials, fuel elements, reactor design, hot laboratories, and economic considerations of nuclear energy. Inquiries about the Congress may be sent to Engineers Joint Council (29 West 39th Street, New York 18, N.Y.), which is coordinating the program for the thirty sponsoring societies.

General Wheeler Receives Hoover Medal for 1958

Presentation of the Hoover Medal for 1958 to Lt. Gen. Raymond A. Wheeler took place on February 19 at a special dinner meeting of the Society of American Military Engineers, of which General Wheeler is a past-president. General Wheeler was Chief of Army Engineers from 1945 until his retirement in 1949. Since his retirement he has been associated with the International Bank for Reconstruction and Development, initially as chief engineer and for the past few years as consultant. He was lent by the Bank to the United Nations to direct the clearance and rehabilitation of the Suez Canal.

The Hoover Medal, one of the most important awards available to the engineering profession, was established in 1930 by the Four Founder Societies to commemorate the civic and humanitarian achievements of Herbert Hoover, Hon. M. ASCE. Inscribed on the medal is the legend, "Awarded by Engineers to a Fellow Engineer for Distinguished Public Service."

Cleveland—Host City to ASCE Summer Convention

Backdrop for the Society's Spring Convention, set for May 4-8, will be the beautiful lake city of Cleveland. This view shows the financial and business district. Hardworking committees, headed by Wendell R. Swatosh, have readied the fine program that appears elsewhere in this issue. On the list of topflight speakers are the head of the Bureau of Public Roads and members of the National Research Council of Canada. Arrangements have been made with Fenn College of Engineering, Case Institute of Technology, and the National Aeronautics and Space Authority for educational exhibits that should prove of great interest.

ASCE ENGINEERING SALARY INDEX

Consulting Firms

City	Current	Last Quarter
Atlanta	1.22	1.11
Baltimore	1.11	1.11
Boston	1.15	1.13
Chicago	1.30	1.26
Denver	1.20	1.19
Houston	1.12	1.08
Kansas City	1.14	1.14
Los Angeles	1.21	1.16
New Orleans	1.21	1.22
New York	1.21	1.17
Pittsburgh	1.05	0.93
Portland (Ore.)	1.11	1.15
San Francisco	1.19	1.17
Seattle	1.06	1.07

Highway Departments

Region	Current	Last Quarter
I, New England	0.89	0.85
II, Mid. Atlantic	1.17	1.17
III, Mid. West	1.25	1.15
IV, South	1.10	1.07
V, West	1.02	0.97
VI, Far West	1.15	1.15

Sole purpose of this Index is to show salary trends. It is not a recommended salary scale. Nor is it intended as a precise measure of salary changes. The Index is computed by dividing the current salary total for ASCE Grades I, II and III by an arbitrary base. The base used is $15,930. This is the total of salaries paid in 1956 for the equivalent Federal Grades GS5, GS7 and GS9. Only the annual base entrance salaries are used in these calculations. Index figures are adjusted semi-annually and published monthly in Civil Engineering. Latest survey was January 31, 1959.

ASCE Membership as of February 9, 1959

Members	10,319
Associate Members	14,681
Junior Members	17,151
Affiliates	79
Honorary Members	44
Total	42,274
(Feb. 10, 1958	40,522)

The Younger Viewpoint

The Voice of the Committee on Junior Member Publications

For this issue "The Younger Viewpoint" is interpreted by the committee member from Zone IV, Rodney P. Lundin.

Committee on Junior Member Publications

Milton Alpern, Chairman; 3536 Northview Ave., Wantagh, L. I., N. Y.

Zone I	Zone II	Zone III	Zone IV
Louis K. Walter, Jr. 320 Market Street Kenilworth, N. J.	Albert C. Nelson 250 N.E. 51st Street Miami, Fla.	Walter D. Linzing 4751 No. Paulina Chicago 40, Ill.	Rodney P. Lundin 9744 Quakertown Ave. Chatsworth, Calif.

Although the interest shown by Junior Members in this, their column, is increasing and more comments are being submitted, the Committee wishes again to emphasize the necessity of a continuous flow of material and ideas in order to make "The Younger Viewpoint" successful.

"We Get Letters"

Some very interesting and thought-provoking questions have been asked in this column since its beginning in August 1958. Let's look at some of the equally interesting answers:

In the August column, the Junior Members of the Illinois Section, in a letter by K. R. Leonardson and W. D. Linzing, asked "How do other Local Sections of ASCE encourage participation of more Junior Members in their activities?"

The Los Angeles Section became aware some time ago of this problem of having a considerable number of interested Junior Members, but insufficient openings on committees to keep them all busy. In order to provide an opportunity for this ambitious group of young engineers to have a say in Section and Society affairs, the Junior Forum (now Junior Member Forum) was formed in March 1930. This group has been exceedingly active up to the present time, preparing Junior Members for the time when they will transfer to higher grades.

This is one answer from a large Section. How about a reply indicating how the smaller Sections encourage participation by Junior Members?

In the same letter from the Junior Members of the Illinois Section, they stated ". . . our employers are reluctant to send us to the national Convention of ASCE."

This is indeed quite a problem. However, it has been observed in Los Angeles, for example, that several private engineering firms encourage their employees to be active in Society affairs and, in addition, pay the employee for travel and other expenses of ASCE Conventions. It should be noted that the employees sent are those who have given much of their time and effort to ASCE. It can be assumed there are firms throughout the country that operate in this manner, and rightly so, for these Conventions work toward the betterment of the Society in general.

It was asked in the September issue what your thoughts were about the statement: "ASCE leaders recommend that Junior Members change grade to Associate Members as soon as possible."

The advisability of changing from Junior Member to Associate Member could depend upon the size of the Section, how Junior Members are treated in the Section, whether a Junior Member Forum is available, etc. What do you think?

In the October issue, Willard J. Sweeney, J.M. ASCE, in his letter from the Canal Zone, says in part ". . . I am curious to know if others agree that more of our universities ought to add some formal instruction to their engineering curriculums concerning personal relations in engineering.

It is interesting to note that this topic and others will be discussed in an article being prepared by the Los Angeles Section's Committee on Engineering Education, based on a recent "Professional Growth Survey" of the Junior Members of the Los Angeles Section. It will be sure to be of interest to all Junior Members.

It seems that Hasan Makarechian, of Chicago, whose application for membership in ASCE took six months to process, is not alone. His story in the January 1959 column brings to light the predicament of other engineers experiencing the same difficulty.

Such delay is extremely unfortunate.

Attention! Junior Members of the Fairer Sex

As yet, no communications have been received from any of the women who are Junior Members of ASCE. The Committee would be happy to have their comments.

Miscellany

The fact that most engineering graduates are uninformed about the subject of office practice has been broached. Some large private and public organizations include this field in their training programs for recent graduates. Some people advocate inclusion of this subject in undergraduate study. What do you think?

The report regarding activities in the Metropolitan Section's Junior Member Forum, contained in the December 1958 issue, was read with interest by the Junior Member Forum of the Los Angeles Section. The 1959 program of the Los Angeles Section Forum is similar to that of the Metropolitan Section in that it is basically non-technical. Subjects for planned programs include: Facilities for the VIII Winter Olympics in Squaw Valley; The Role of the Flight Surgeon in the Space Age; Aircraft Accident Investigation; The Views of an American Engineering Economist During His Travels in Turkey; and a report on the "Professional Growth Survey." In addition to these dinner meetings, the Los Angeles Forum carries on a full program of committee activities.

You will notice on the masthead the appointment of a new representative for Zone II. Al Nelson can do a fine job with your cooperation.

NOTES FROM THE LOCAL SECTIONS

(Copy for these columns must be received by the fifth of the month preceding date of publication)

Two guest speakers from the American Bridge Division of the U. S. Steel Corporation, Paul Powell and Bill Thatcher, presented a colored movie and accompanying talk on the construction of the Mackinac Bridge at the **Akron Section's** January 8 get together. Wendell LaDue, superintendent of the Akron Water Department, received his ASCE Life Membership award and was simultaneously honored by the mayor of Akron and the City Council "for his many years of faithful service to the profession." Mr. LaDue recently presented an Analytical Balance to the Civil Engineering Department of the University of Akron. Unanimously elected officers for 1959 were: Charles E. Cockerham, president; Calvin R. Clauer, vice president; and Phillip E. Doane, secretary-treasurer.

Guest speaker at the annual meeting of the **Anchorage Branch** of the **Alaska Section** on January 17 Donald Barnes, one-time editor of CIVIL ENGINEERING, gave an informal talk on engineering experiences and humorous incidents connected with his recent work in Burma. Mr. Barnes recently completed a planning assignment in Burma for the Burmese Government and is enroute to Ethiopia for the Bureau of Reclamation under sponsorship of the International Cooperation Agency. Mrs. Barnes spoke briefly of her social service and cultural relations work among the Burmese. New officers installed at the meeting are: John R. Watson, Jr., president; Daniel J. Dougherty, vice president; and Ronald H. Hutchens, secretary-treasurer.

Gordon F. Gray, Captain, U. S. Air Force, and an instructor in the department of mechanics at the new Air Force Academy and his assistant, Lieutenant Christiansen, gave an enlightening talk at the **Colorado Section's** January 12 meeting. The talk dealt with the method of computer programming in the study of minimum weight and minimum cost in roof-system proportions.

The **Connecticut Section** will be host to the Annual Conference of Sections in the New England Council, to be held at the University of Connecticut in Storrs on April 4. Speakers at the morning and afternoon sessions will be: Carl B. Brown, Soil Conservation Service; William S. Wise, Connecticut State Water Commission; T. William Lambe, Massachusetts Institute of Technology; Norris Andrews, New Haven City Plan Commission; and John B. McMorran, Superintendent of Public Works of the State of New York. ASCE President Francis S. Friel will address the luncheon meeting. A dinner will conclude the Conference.

Those attending the **Georgia Section's** 46th annual meeting heard an address by President Francis S. Friel, delivered in his absence by Robert E. Stiemke. Entitled "Society Affairs," the address had to do with the value of membership in ASCE, unity of the profession, the United Engineering Center, the obligations of membership in the Society, and a look into the future. At the dinner retiring President Kindsvater announced the Section's new officers: John E. Bing, president; Lewis A. Young, vice president, resident; Thomas H. Freeland, vice president, non-resident; and Richard King, secretary-treasurer. The directors are: C. P. Lindner, resident; James L. Lindsey, non-resident; and Fenley Ryther, Jr., junior.

Verner L. Lane (right), senior contact member for Indiana Section's Northwestern Branch to University of Notre Dame Student Chapter, is awarded honorary membership in the Chapter for his efforts to help the group with its programs. With Mr. Lane are Chapter President Richard Kavanney (left) and Faculty Adviser James A. McCarthy.

New and retiring officers of Mid-South Section's Little Rock Branch are shown here. Seated are Margaret Peterson, vice-president, and John W. Courter, president. Standing are retiring President W. Dewoody Dickinson, Jr.; Edwin R. Beckel, new secretary-treasurer; and retiring Secretary-Treasurer J. L. McKinstry.

Illinois Section officers recently elected for 1959 are: Robert L. Kennedy, president; John G. Hendrickson, Jr., vice president; Paul H. Kaar, treasurer (two-year term); and Robert L. Hall, secretary.

At the annual meeting of the **Northwestern Branch** of the **Indiana Section,** held January 13, the following new officers were elected: Arthur P. Arndt, president; Wallace W. Webb, vice president; and Arthur H. Plautz, secretary-treasurer.

At the January 19 meeting of the **Kansas Section,** President Robohn relinquished the chair to President-Elect Frank Virr. Other new officers unanimously elected are: Richard Page, vice president, and Dale Dugan, secretary-treasurer.

John Wise, of Disneyland, reminded those attending a recent meeting of the **Orange County Branch** of the **Los Angeles Section** that the receipts that Disneyland takes in—annual average receipts are over $4 million—help Orange County. To date $23 million have been spent in building Disneyland, and projected projects—a submarine ride, matterhorn, and monorail—will cost approximately $5 million more. M. J. Skinner, president of the Los Angeles Section, was special guest.

The **Junior Member Forum** of the **National Capital Section** is sponsoring a course in electronic computers for civil engineers. The sessions which are being held Thursday evenings through May 7 are conducted by local computer experts, and are limited to twenty-five persons. It is hoped that the course will provide the background needed for distinguishing which of the engineer's problems can profitably be solved by computer.

At a recent **Oregon Section** meeting Anthony Brandenthaler, chairman of Oregon's Centennial Commission, presented an outline of the centennial plan. The plan calls for a world's trade fair, which could boast of Oregon's wheat, its mighty timber, its shipping facilities and would create both short and long term economic gains for the state. The fair will be the first in the U. S. to feature atoms for peace. The Section has elected its 1959 officers: Walter J. Bushnell, president; John T. Merrifield, first vice president; John H. Collins, second vice president; and John R. Gray, secretary. Marvin W. Runway is the new director-at-large.

There was standing room only for the symposium on "The Greater New Orleans Bridge" at the January 13 meeting of the **Philadelphia Section.** Three engineers described the Bethlehem Steel Company's role in building the nation's longest cantilever bridge, and the engineering design history: Frank M. Masters, consulting engineer, Modjeski & Masters; L. L. Feidler, resident engineer, Bethlehem Steel Company; and E. L. Durkee, engineer of erection, Bethlehem Steel Company. Only the lateness of the hour ended the discussion from the floor following the speeches. ASCE President Francis S. Friel addressed the meeting on the progress of the United Engineering Center Fund Campaign.

On January 10, the **Marysville Branch** of the **Sacramento Section** held their annual dinner-dance and installation of new officers. Elected president is C. H. Brumund; vice president, Ray Miller; secretary, B. Henderson; and treasurer, R. Jacobs. Highlights of the **Nevada Branch's** annual Ladies Night banquet was the installation of new officers. They are: Don Clendenon, president; Vern Meiser, vice president; and Tom Meredith, secretary-treasurer. Howard Wicks and Wally Rabenstine were elected directors.

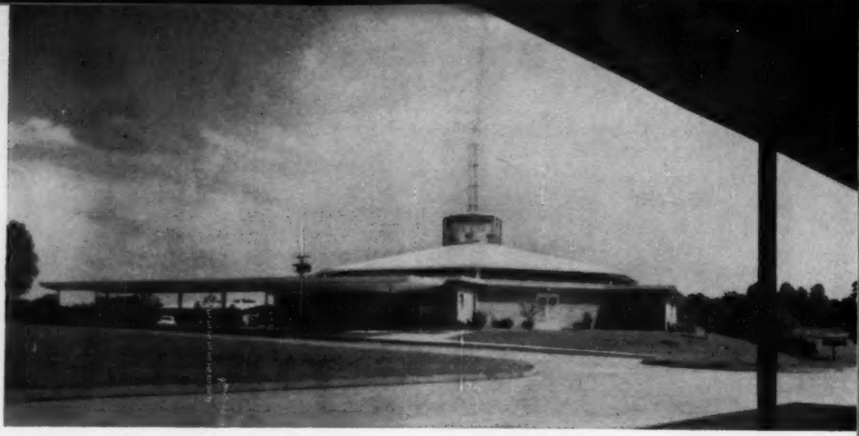
Incoming officers of the Mohawk-Hudson Section are pictured here, in usual order: William G. Wilkie, second vice president; E. E. Dittbrenner, treasurer; Cliff S. Barton, president; R. Vincent Milligan, secretary; and Haaren A. Miklofsky, first vice president.

John E. Rinne, supervisor of the Civil and Architectural Division of the Standard Oil Company of California, presented a well-illustrated talk on the "Design and Construction of the Summerland Offshore Platform" at a recent meeting of the **San Francisco Section.** Located near Santa Barbara, about two miles offshore, this structural platform was constructed in over 100 ft of water. A lively question-and-answer period followed. The results of the election of 1959 officers were announced: president, H. E. Davis; vice president, Byron L. Nishkian; secretary, Robert T. Lawson; and treasurer, James E. McCarty.

Robert Shubinski, an instructor in the civil engineering department of the A. & M. College of Texas, is the new editor of "The Texas Engineer," organ of the **Texas Section.** Mr. Shubinski is a native of Dallas and a graduate of Rice Institute where he received his BS in civil engineering.

In January, members of the **Chattanooga Branch** of the **Tennessee Valley Section** heard Dr. Karel Hujer, associate professor of physics and astronomy at the University of Chattanooga, describe methods of space measurement. He illustrated his talk with photographs taken through Palomar Observatory's 200-in. telescope. The speaker at the **Knoxville Branch's** January 14 meeting was Prof. James T. Price of the University of Tennessee, who outlined the university's hydraulic research program, underway since 1949, to determine the effects of the size and spacing of roughness elements in pipes upon the resistance coefficients and velocity distributions of uniform turbulent flow.

Alexander Brest (standing left), executive in Duval Engineering and Contracting Company, Jacksonville, Fla., was featured speaker at meeting of Florida Section's Jacksonville Branch on January 27. Here he receives ASCE Life Membership Certificate from Col. Paul D. Trexler, district engineer of the Jacksonville District of the Corps of Engineers. New Branch officers, shown in photo, are W. S. Eisenberg (standing right), president; W. H. Mahoney (seated right), vice president; and A. Baxley (seated left), secretary-treasurer.



ST. JOHN'S CHURCH, McLEAN, VIRGINIA

Architects: Francis L. Koenig, combined with Soulé & Donnally

Structural Engineer: Edward J. Scullen & Assoc.

General Contractor: Burroughs & Preston

Structural Steel Fabricator: Southern Iron Works

Octagonal auditorium roof fabricated from USS Structural Steel makes a pleasing design. This shape permits maximum seating close to altar.

New Life Members in the Metropolitan Section were honored by the Section at a cocktail party held at the Engineers Club in New York on January 21. Those attending are shown here. In the foreground Section President Richard Tatlow, III (left) presents a certificate to new Life Member Jacob Feld.

ASCE CONVENTIONS

CLEVELAND CONVENTION

Cleveland, Ohio
Hotel Cleveland
May 4-8, 1959

ANNUAL CONVENTION

Washington, D. C.
Hotel Statler
October 19-23, 1959

NEW ORLEANS CONVENTION

New Orleans, La.
Jung Hotel
March 7-11, 1960

TECHNICAL DIVISION MEETINGS

JET AIRPORT CONFERENCE

Houston, Tex.
Shamrock-Hilton Hotel
May 20-22, 1959

Sponsored by
ASCE Air Transport Division
Houston Branch of
Texas Section

HYDRAULICS CONFERENCE

Fort Collins, Colo.
Colorado State University
July 1-3, 1959

Sponsored by
ASCE Hydraulics Division
Colorado Section
Colorado State University

DISTRICT CONFERENCES

NEW ENGLAND CONFERENCE

Storrs, Conn.
University of Connecticut
April 14

Sponsored by
New England Sections

LOCAL SECTION MEETINGS

Colorado—Dinner meeting at the Oxford Hotel in Denver, April 13, at 6:30 p.m.; Soil Mechanics and Foundations Division meeting in the Stearns-Roger Building the first Wednesday of each month, at 7:30 p.m.; Structural Division meeting in the Stearns-Roger Building the third Thursday of each month, at 7:30 p.m.; Hydraulics and Irrigation and Drainage Divisions joint meeting in Room 111, of the Denver Public Library the fourth Wednesday of each month, at 7 p.m.

Indiana—Meeting of the Northwestern Branch at Wilson's Restaurant in Gary, March 25.

Los Angeles—Meeting of the Junior Member Forum at the Engineers' Club in the Biltmore Hotel, Room 3333, March 26, at 7 p.m.; dinner meeting of the Sanitary Engineering Group at the Engineers' Club, March 25, at 6:30 p.m.; dinner meeting of the Soil Mechanics Group at the Engineers' Club, March 18, at 6:30 p.m.; dinner meeting of the Construction Group at the Engineers' Club, March 19, at 6:30 p.m.; reception and dinner meeting of the Transportation Group at the Engineers' Club, March 26, at 6:30 p.m.; dinner meeting of the San Bernardino-Riverside Counties Branch at Mike's Grill, Riverside, April 21, at 6:30 p.m.

Metropolitan—Dinner meeting at the Tavern-on-the Green, March 16, at 7 p.m.

Philadelphia—Regular meeting at the Engineers' Club, April 14, at 7:30 p.m.; meeting of the Construction Division at the Engineers' Club, March 25.

Pittsburgh—Joint afternoon and evening meeting with the Pittsburgh Bicentennial Association in the New Bell Telephone Company Building in Gateway Center, downtown Pittsburgh, March 24. A cocktail hour and dinner will be held at the Gateway Plaza Restaurant at 6 p.m.

San Francisco—The spring meeting of the Construction Division will be held on March 19. Program will feature new stadium for the San Francisco Giants. A field trip to the stadium is planned for March 21.

Tennessee Valley—Spring meeting at Muscle Shoals, April 24-25. Program includes a field trip to the new Wilson Lock and Bridge which are near completion.

Texas—Spring meeting at Corpus Christi April 30-May 2; regular meetings of the Austin Branch at the Austin Engineers and Associates Club the third Thursday of each month, at 7 p.m.; meetings of the Dallas Branch of the Hotel Adolphus the first Monday of each month, at 12:15 p.m.; meetings of the Fort Worth Branch at the Hilton Hotel the second Monday of each month, at 12:15 p.m.

Virginia—Norfolk Branch meeting at the YMCA Cafeteria the third Monday of each month, at 12 noon; Richmond Branch meeting at the Hot Shoppe Cafeteria the first Monday of each month at 12:15 p.m.; Roanoke Branch meeting in the S & W Cafeteria the second Wednesday of each month, at 6:30 p.m.

Wisconsin—Meeting at Marquette Union in celebration of the 50th Anniversary of the M. U. College of Engineering on March 26; joint meeting and banquet with the University of Wisconsin Student Chapter at the new Park St. Labor Temple in Madison on April 10.

BY-LINE WASHINGTON . . . .

The Senate has just passed a $465-million airport construction program and by the time this is read, it is anticipated that the House will also have taken some kind of action. The scheme would provide $100 million a year for four years (plus $65 million for a special "discretionary" fund) to help finance improvements at several hundred airports around the country. State and local governments would match the federal aid, 50-50.

GOP Senators warned their colleagues that the big program disregards the economy budget President Eisenhower has sworn by and that a veto may be forthcoming. In an attempt to avert this move, Senate leaders arbitrarily chopped $100 million off the $565-million program recommended by its committee.

* * *

Meanwhile, state highway departments have completed the long engineering "tooling up" period preparatory to boosting contract awards. Henceforth, Bertram D. Tallamy, Federal Highway Administrator, said last month, it should not be difficult for roadbuilders to maintain a high level of new project starts.

In brief, the status of the interstate job is as follows, Mr. Tallamy claimed:

Completed or under way	11,463 miles	28.3 percent
Surveys, designs and right-of-way completed or under way	16,843 miles	41.3 percent
Not yet started in any way	12,368 miles	30.4 percent

(The above mileages include segments completed as toll roads and free roads meeting Interstate System standards.)

Highway construction costs are up again. Bid prices during the fourth quarter of 1958 nudged upward 1.7 percent over the preceding quarter, the Bureau of Public Roads reported. However, costs were down 1.2 percent from the same period in 1957. Greatest change over prices of twelve months previous was for steel. Reinforcing steel was 4.1 percent less during the fourth quarter of 1958, compared to the same quarter of 1957. Structural steel was 8.9 percent less.

* * *

Efforts are being renewed for a new federal transportation policy and a new agency to administer it. Advocates point to traffic snarls on highways and airways and to the unhealthy condition of the nation's railroads as justification for Uncle Sam to develop broad remedial programs. The main purpose of the organization would be to regulate rates in such a way as to encourage growth and efficiency in the operations of all forms of transportation. But the agency would also implement any long-range reconstruction programs conceived.

The Engineers Joint Council has long urged such a program, just as it has backed water resource development. The big National Highway Program has stimulated new appreciation for transportation in our economy. The advent of the jet passenger plane has revealed striking inadequacies in our airport facilities. The obsolescence of our railroads has a number of national leaders concerned. And the obvious benefits of the St. Lawrence Seaway have whetted the appetite of shipping interests. Transportation experts here foresee a fresh endeavor to push modernization of all these forms of transportation.

* * *

The Bureau of Public Roads has come through with two alternate methods by which Congress can reimburse the toll authorities and the state highway departments for segments of the 41,000-mile Interstate System which they built on their own before passage of the big federal-aid Interstate bill. Chances are that no reimbursement will be made, however, as long as the legislators have trouble raising money for new construction. About 10,859 miles of the Interstate System have already been built by toll financing or other state funds. Some must be up-graded to modern standards.

A resolution urges that the facilities of private engineering organizations be utilized to expedite the highway program and assure maximum efficiency and economy. Many states are still having difficulty obtaining highly qualified engineers, according to the American Road Builders Association, and there is ample capacity within the ranks of consultants to meet all engineering requirements of the accelerated road program.

* * *

The shift in U. S. defense concepts from dependence upon bombers to reliance upon guided missiles is radically changing the military construction program. Maj. Gen. E. C. Itschner, M. ASCE, Chief of Engineers, U. S. Army, described how quickly this transformation is being hastened. The Corps will let contracts for $600 million worth of missile launching bases this year for the Air Force and Army. In time, this type of project will largely replace the big bomber runway and service facilities so familiar to civil engineers.

The missile base program is a "crash" effort which is forcing designers to make numerous changes as construction proceeds. In cases, construction of launching facilities must proceed even before the missile itself is completely designed. General Itschner cited one project on which 70 design changes were necessitated during the 30-day advertising period alone. He predicted that a number of missile bases will be constructed around the country in a "tremendous" program that will be complex and costly.

There will be more money for engineers called upon to serve the federal government as consultants as a result of recent Congressional legislation. First upward move was an increase from $50 a day to $60 for the services of experts to the Department of Defense. Then a provision of $100 a day was included in the act creating the new National Aeronautics and Space Administration. More recently, legislation creating the new Federal Aviation Agency included provision for the same higher per diem.

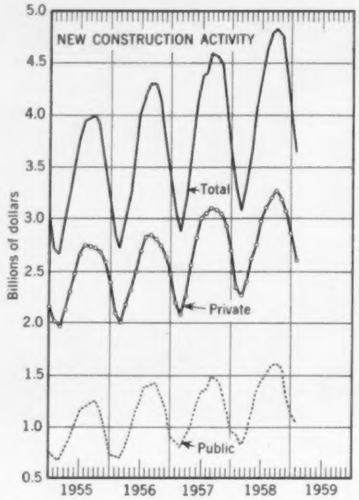
NEWS BRIEFS . . .

January Construction Activity Exceeds 1958 Record High

Though new construction activity in January declined seasonally from December, the $3.7 billion put in place exceeded the previous record high for the month set in January 1958, according to preliminary joint estimates of the U.S. Departments of Commerce and Labor.

Both private and public construction expenditures contributed to the 10 percent rise over last January. Private outlays, at $2.6 billion, were 8 percent above the comparable 1958 month, over-the-year decreases in industrial construction and office building being more than offset by sharply increased spending for new dwelling units and by more modest gains in most other types of private construction. Public construction was 15 percent above the January 1958 level, largely the result of continued strength in public housing and highways.

The joint agencies note that their monthly construction estimates are determined primarily by past contract award movements, standard progress patterns, and assumed normal seasonal movements. Except in the case of special surveys, the estimates do not reflect the effects of varying numbers of working days in different months, nor of special conditions influencing the volume of activity in any given month, such as unusual weather, materials shortages, overtime, work stoppages, and postponements. General indicators of future trends in activity are housing starts, contract awards, building permits, and materials output.



New construction activity in January declined seasonally to $3.7 billion, which is a 10 percent rise over previous record high for the month set in 1958.

Disaster Relief Plan Proposed at AGC Convention

A disaster relief plan that would enable the powerful construction industry to make its equipment, personnel, and know-how available to local government units in the event of disaster was outlined at the fortieth annual meeting of the Associated General Contractors of America, held in Miami Beach, Fla., January 19-22. The program, known as "Plan Bulldozer," provides administrative and organizational directions that the 124 AGC chapters and branches can follow to make their resources available for disaster relief in their areas.

In presenting the plan to the convention, Robert M. Hoover, of Kansas City, Mo., chairman of the AGC Disaster Relief Committee, said the contractors' mission in disasters—either natural or man-made—would be to furnish materials, equipment, and personnel "where, when, and as long as desired by whatever civil or military authority is in charge of disaster control." Some of the chapters and branches reported that they have already begun to set up their disaster relief units.

Defense and its allied problems loomed large on the convention program. Maj. Gen. E. C. Itschner, M. ASCE, Army Chief of Engineers, told the group that, "The side which can most quickly dig its way out of the debris of the initial attack and marshal what is left of its economic and military strength is going to have the best chance of winning the next war." In recovering from the initial attack, General Itschner stated, "construction men, equipment, and know-how will bear an importance second only to the armed forces." For instance, he said, "if a city were hit by a 10-megaton nuclear surface burst, it would take 75,000 men nearly a month just to decontaminate the area to permit rescue and rehabilitation work to proceed." To clear the streets, he estimated, it would require 1,200 power shovels, 1,200 drag lines, 2,000 bulldozers, 1,000 trailers, and 7,000 trucks. In short, he said, "you come up with a construction job that staggers the imagination."

Another chilling note was struck in a talk by Dr. Wernher von Braun, director of the Development Operations Division of the Army's Ballistic Missile Agency. Dr. von Braun warned that, in the second year of the space age, the United States has "not yet met the challenge" of the Soviet Union in the development of its missile and space rocket programs. "We are moving in that direction," he said, "but unfortunately we still cannot claim parity, much less superiority." He noted that the Soviet Union's long-range space program has been announced by the Soviet Academy of Sciences, and that "there can be no possibility of mistake in evaluating Soviet intentions as far as outer space is concerned."

Financing the Interstate Highway Program was another principal convention topic. Federal Highway Administrator Bertram D. Tallamy, M. ASCE, headed a battery of important speakers in the highway and legislative field. Mr. Tallamy warned that a serious setback in the interstate highway program can be expected in 1961 unless congress acts to provide additional financing. There is some confusion in the public mind, he said, as to the reason why the highway program is in danger of a cutback. The idea that it is caused by increased costs is a misconception, he noted. The immediate bottleneck, he added, "is the provision of sufficient funds to keep the program in pace with the authorizations which were set forth in the Highway Act of 1956". Mr. Tallamy predicted that Congress will soon "come to grips" with the financing problems of the highway program.

Among other top-flight speakers were Senator Albert Gore, former chairman of the Senate Subcommittee on Public Roads; Rep. George N. Fallon, chairman of the House Subcommittee on Roads; W. A. Dexheimer, M. ASCE, Commissioner of the Bureau of Reclamation; Rear Admiral E. J. Peltier, A. M. ASCE chief of the Navy Bureau of Yards and Docks; and Maj. Gen. A. M. Minton, director of installations for the Air Force.

The convention went on record as strongly opposed to federal financing of school construction on the ground that it would add to the cost of construction and, even more important, that it would be a step toward federal control of education.

In the closing session of the convention James W. Cawdrey, of Seattle, Wash., was installed as 1959 president of the AGC. John A. Volpe, of Malden, Mass., was installed as vice president. Mr. Cawdrey, a member of the building firm of Cawdrey & Vemo, succeeds Fred W. Heldenfels, Jr., highway contractor of Corpus Christi, Tex.

Mississippi River Clean-up Continues

A major step toward controlling Mississippi River pollution through treatment of waste has been taken by the Metropolitan St. Louis Sewer District with award of a $240,000 contract for a 30-month study of pollution and recommendations for its abatement. The study will be made by Horner and Shifrin, St. Louis consultants, with the aid of Havens and Emerson, Cleveland engineers specializing in sewage treatment. It will make specific recommendations for the number and type of treatment plants required and methods of financing. The study will be financed by a loan approved by the Housing and Home Finance Agency.

Award of the contract results from a conference on pollution, held last spring, between the Metropolitan Sewer District, the U.S. Public Health Service, and the State Water Pollution Board. At that time the federal government notified the District that St. Louis is the last major community discharging raw and improperly treated sewage into an interstate navigable stream and set the deadline of 1967 for correcting the situation.

Builders Chosen for New Lincoln Center

The builders of the United Nations secretariat have been retained for the construction of Lincoln Center for the Performing Arts, New York's new cultural center. The joint venture group consists of the Turner Construction Company, the George A. Fuller Company, the Walsh Construction Company, and the Slattery Contracting Company, and will be known as Fuller-Turner-Walsh-Slattery.

Construction of the Center on a twelve-acre site between 62nd and 66th Streets in the Columbus Circle area of Manhattan will begin this spring with the breaking of ground for the new Philharmonic Concert Hall. The Concert Hall and the new Metropolitan Opera House are both scheduled for completion by the summer of 1961. The Center's four other buildings, including a theater and library-museum of the performing arts, will be completed by 1963. Preliminary cost estimates of $60,000,000 for the land and buildings have been raised to $75,000,000.

Work Starts on New Niagara Falls Bridge

A continuous girder bridge, with the longest unsupported main span of any bridge of its type in the United States, will link the city of Niagara Falls with Goat Island in the Niagara River. The main span—450 ft. shoe-to-shoe atop the abutment piers—will be erected by cantilevering from the Niagara Falls side to temporary falsework in the stream, and then by cantilevering from there to the Goat Island abutment. Erection will start this spring. The Bethlehem Steel Company is erecting the project for the New York State Power Authority as part of a plan to develop the recreational possibilities of the island. Praeger-Kavanagh, of New York City, are the engineers for the bridge.

Highway Financing Problems Hold Spotlight at ARBA Convention

Problems of financing the construction of the Interstate Highway System while maintaining a balance in the Federal-aid ABC programs held the spotlight at the 57th annual convention of the American Road Builders Association at Dallas, Tex., January 19-22. The ARBA took a formal stand on the issue in a resolution stating that it will "work diligently" to keep the National Highway Program moving on schedule. The resolution also offered a "sound and workable plan" to keep the program moving:

1. Revise authorizations as needed to reflect revised cost estimates and to provide increased authorizations for the primary and secondary systems in order to maintain a reasonable balance with the authorizations for the Interstate System.
2. Suspend the Byrd Amendment to permit bond financing of the Highway Trust Fund.
3. Suspend the termination date of the Highway Trust Fund.
4. As an interim solution, provide immediate ways and means to finance the anticipated deficits in the Trust Fund, 1960 through 1963.
5. Using the 1961 economic study as a basis, provide adequate revenue to support the Highway Trust Fund to the conclusion of the program.

The convention took this action after Louis W. Prentiss, M.ASCE, vice-president of the ARBA, had presented an analysis of the situation, with regard to the Highway Trust Fund. General Prentiss pointed out that the total income for the Trust Fund through 1972 will be adequate to finance the program to the extent of about $12.6 billion. He also noted that the Secretary of Commerce was directed by the amended Federal-Aid Highway Act of 1956, to make a study in order to provide Congress with information that will aid it in determining what federal taxes should be imposed in order to assure an equitable distribution of the tax burden among the various classes of highway users. When this study is in hand, General Prentiss observed, Congress will be in a better position to establish a long-range financing plan for the Highway Trust Fund. Since revenue from this plan would not begin to come into the Trust Fund before fiscal 1963, General Prentiss stated that some interim plan of financing must be established in order to carry the program in the intervening years. He outlined such a plan, calling for some borrowing from the general fund or for resort to bonds.

Some of the same sentiments were echoed by Federal Highway Administrator B. D. Tallamy, M.ASCE, in another convention address. "We must have a long-range financing program," Mr. Tallamy said, "but we don't have the information on which such a program can be based." He said that Congress will be in a better position to set up such a program when it has the results of (1) the economic study of the benefits of the Interstate System, and (2) the AASHO Road Test.

Mr. Tallamy reported that the Interstate Program is 7 percent ahead of schedule for the period 1956-1958.

The legislative forum, with two Senators and two Representatives participating in an informal discussion, was one of the most informative sessions in recent convention history. Participating were Sen. Dennis Chavez, chairman of the Senate Public Works Committee; Sen. Francis Case, ranking minority member of the Senate Public Works Committee; Rep. George H. Fallon, ranking majority member of the House Public Works Committee and chairman of the Subcommittee on Roads; and Rep. William C. Cramer, of Florida.

A fifth Congressional speaker was Sen. Jennings Randolph, newly appointed member of the Senate Public Works Committee and past treasurer of the ARBA. In the featured address at the Road Builders' Luncheon, Senator Randolph stressed highways and schools as important to the democratic way of life.

New Officers Installed

At the conclusion of the convention President Julien R. Steelman completing a two-year term as head of the organization, turned over the leadership of the association to the incoming president, Nello L. Teer, Jr., president of the Nello L. Teer Co. of Durham, N. C. Reelected as vice-presidents are: J. E. McCracken, of Bethlehem, Pa., for the Northeastern District; Harold L. Plummer, of Madison, Wis., for the Central District; and W. A. Bugge, M. ASCE, of Olympia, Wash., for the Western District. J. N. Robertson, M. ASCE, director of highways for the District of Columbia, has been elected treasurer after serving several months as acting treasurer.

The Fifth Annual Highway Materials and Services Exhibit, held in conjunction with the convention, attracted good crowds throughout the meeting.

Contest for Best Paper On Structural Foundations

The Raymond Concrete Pile Company, a division of Raymond International Inc., announces the opening of its second annual Alfred A. Raymond Award. The prize of $1,000 will go for the best paper on the engineering of structural foundations. The deadline for manuscripts is September 1, 1959.

Papers may deal with any phase of foundation engineering, soil investigation, theoretical or applied soil mechanics, and design or construction techniques. This year the contest has been broadened to include engineering undergraduates. Graduate and undergraduate theses on foundation engineering are eligible. Named after the founder of the Raymond firm, the award was established last year "to encourage originality in research and development in the field of foundation engineering."

Engineers interested in submitting papers should register and ask for instructions, addressing their letters to the Alfred A. Raymond Award, Room 1214, 140 Cedar Street, New York 6, N. Y.

Last year's award went to Martin S. Kapp, J.M. ASCE, of the Port of New York Authority, for a paper describing a new technique for soil consolidation.

Large Bridge Nears Completion in New Zealand

When this New Zealand bridge, connecting the City of Auckland with the borough of Northcote, is completed in May it will be the longest built in the Southern Hemisphere in the past twenty years. Over-water length is 3,520 ft, and total length with approaches is 2¼ miles. The photo shows one of the main spans, 580 ft long and weighing 1,200 tons, being floated into position at high tide. The $9,702,000 building contract went to two British companies—Dorman Long and Co. and the Cleveland Bridge and Engineering Co. Freeman, Fox & Partners, of London, were the engineers.

Kaiser Opens Large Oxygen Steel Plant

Official dedication of Kaiser Steel's revolutionary basic oxygen steelmaking facilities—the largest in the world and the first in the West—took place on February 1 at the company's Fontana, Calif., plant. California's Governor Edmund G. (Pat) Brown and Henry J. Kaiser, chairman of the board of Kaiser Steel, officiated at the dedication, which was highlighted by the refining and pouring of the first official heat of oxygen steel. The entire process took 25 minutes instead of the hours required in conventional methods.

Opening of the steelmaking facilities completes all major installations in Kaiser Steel's $214,000,000 expansion program, which was initiated 2½ years ago. The program has increased the company's annual ingot capacity from 1,536,000 tons to 2,933,000 tons, making the Fontana plant the largest steel mill west of the Mississippi.

Consulting Engineers Elect New Officers

George S. Richardson, M. ASCE, of Pittsburgh, Pa., has been elected president of the American Institute of Consulting Engineers, succeeding Herschel H. Allen, M. ASCE, of Baltimore, Md. Mr. Richardson is senior partner in the Pittsburgh consulting firm of Richardson, Gordon and Associates.

The new vice-presidents will be Emil H. Praeger, partner in the New York consulting firm of Praeger-Kavanagh, and Dean G. Edwards, partner in Edwards and Kelcey, consulting engineers of Newark, N. J. Both are members of ASCE. Elected to the Governing Council are ASCE Members S. C. Hollister, dean of engineering at Cornell University; Harold M. Lewis, consulting engineer of New York, N. Y.; and Gerald T. McCarthy, partner in the New York consulting firm of Tippetts-Abbett-McCarthy-Stratton.

Demonstration Nuclear Plant for South Carolina

The Atomic Energy Commission has signed a contract with Carolinas Virginia Nuclear Power Associates for a demonstration nuclear power plant to be built at Farr, S. C., near Columbia. The contract covers the design, development, construction, and test operation of a heavy water-moderated pressure tube-type reactor fueled with slightly enriched uranium. The plant will produce steam for use in an adjoining conventional power station. Net electrical capacity will be 17,000 kw. Under the contract, the power group will pay the capital costs, estimated at approximately $22,000,000.

Companies in the Carolinas Virginia Nuclear Power Associates are the Duke Power Company, Charlotte, N. C.; the South Carolina Electric & Gas Company, Columbia, S. C.; the Carolina Power & Light Company, Raleigh, N. C.; and the Virginia Electric & Power Company, Richmond, Va.

Know Your Materials

Today's engineering students have more to learn about the materials they will use than any other generation of students. Reactors, rockets, and space vehicles impose sharp new challenges, and reliability of materials is more than ever important. To explore the vital question of how engineering materials can best be taught to engineering students, two of the societies most concerned with the problem—the American Society for Engineering Education and the American Society for Testing Materials—are sponsoring a joint Symposium on Education in Materials at the ASTM annual meeting in Atlantic City, June 22-26.

Inquiries may be addressed to the ASTM, 1916 Race Street, Philadelphia 3, Pa.

New Bauxite Source for The Aluminum Industry

A new source of bauxite for the United States aluminum industry became available late in January with the delivery of the first shipment of Dominican Republic ore to the Aluminum Company of America's new alumina-refining plant at Point Comfort, Tex. The 7,300-ton shipment marks the first time in history that bauxite has been exported from the Dominican Republic. Regular shipments of Dominican bauxite to Point Comfort will begin early in March.

The first ore shipment culminates several years of exploration and development work by the Alcoa Exploration Company in the Dominican Republic at an initial cost of $14,000,000.

Hawaii Pushes Koolau Tunnel Project

Work on the 2,778-ft highway tunnel through the Koolau Mountain range on Oahu Island has passed the two-thirds mark, and the contractors—E. E. Black Ltd., of Honolulu, and Gibbons & Reed, of Salt Lake City—expect to beat their June 1959 scheduled completion date. Rated as one of Hawaii's most difficult and expensive tunnel projects, the $3,845,352 bore cuts through a soft volcanic formation, paralleling the already finished John H. Wilson Tunnel. The twin bores will serve as key links in a new route cutting travel time between Honolulu and the Kaneohe Bay area on the east side of the Island. Speeding traffic between Honolulu and Kaneohe Bay is especially important because of the location of a major Naval Air Station there. The project is being built for the City and County of Honolulu, of which Yoshio Kunimoto is chief engineer.

Converting Shreveport Stadium Into Auditorium

This 900-ton arc-welded structural steel frame envelops an 8,000-seat concrete stadium on the Louisiana State Fair Grounds at Shreveport, converting it into a Youth Activities Building. Five continuous arch girders on the sides have width of 226 ft and center height of 82 ft. Seven horizontal rows of open-web bar cross frames, bolted to stiffeners on the girder webs, tie the 26 girder legs together. Steel purlins were laid over the cross frames and welded in place, forming additional support for the sheet copper roof that covers the entire structure. Eight radial half-arches at each end are pinned at the top to the large spider bracket of welded steel plate. At a cost of less than $1 million, the project converted the stadium into a modern $1.5 million fully enclosed plant. E. M. Freeman Associates, of Shreveport, were the engineers, and Southern Builders, Inc., of Shreveport the contractor. Erection was handled by H. D. & J. T. Crigger, of Dallas. Photo courtesy of the Lincoln Electric Company.

New Facilities for Port of Baton Rouge

In the span of thirty months a vast new industrial complex has risen on the shores of the Mississippi River at Burnside, La., approximately 30 miles below Baton Rouge. The development was dedicated on January 21. In the foreground is the massive $15,000,000 Burnside Bulk Marine Terminal, a public facility that helps make Baton Rouge one of the country's top ten deep-water ports. The facility is expected to handle 1,750 to 2,000 barges and 150 ships in 1959. (Another part of the Greater Baton Rouge Port Development was described in the January 1958 issue, page 44.) Towering in the background is a giant $55,000,000 Ormet Corporation alumina plant—owned jointly by Olin Mathieson Chemical Corporation and Revere Copper and Brass Inc. The F. H. McGraw Co. was the contractor for both projects. Singmaster & Breyer, of New York, designed the process units and structural and mechanical features; Bernard & Burke, of Baton Rouge, the utilities and dock; and R. R. Popham, of New York City, the steam plant.

U.S. Contractors Honored For Work on Spanish Bases

Three general contracting firms were honored by the Secretary of the Navy with Certificates of Merit at a presentation ceremony in Washington, D. C., on February 3, for their part in the $322,000,000 Spanish bases construction program. The certificates were presented by Assistant Secretary of the Navy (Air) Garrison Norton. The firm's representatives were introduced by Rear Admiral E. J. Peltier, A. M. ASCE, Chief of the Bureau of Yards and Docks.

The firms are Brown and Root, Inc., Houston, Tex.; Raymond International Corporation, New York City; and the Walsh Construction Co., Davenport, Iowa, and New York City. The three firms formed the joint venture of Brown-Raymond-Walsh, which was selected in January 1954 by the Navy Bureau of Yards and Docks as the construction contractor for the Spanish bases program, now nearing completion.

The integrated base system in Spain includes three major U. S. Air Force fighter-bomber bases, a group of small material and supply and communications facilities, a system of facilities for storage and transmission of liquid petroleum products connected to a point of supply, a Naval Air Station with port fuel and ammunition storage facilities, and two subsidiary Naval facilities for fuel and ammunition storages, and a chain of auxiliary stations.

After the Spanish bases agreement was signed by Spain and the United States in September 1953, the Bureau of Yards and Docks was designated the construction agency to carry out the Air Force and Navy construction programs. The construction of the bases is the largest project in the peacetime history of the Bureau.

Base Facilities for ICBM Missile

Plans are well under way for design and construction of the initial TITAN ICBM missile facilities, according to Maj. Gen. Bernard A. Schriever, commander of the Air Force Ballistic Missile Division. A contract for the design of the initial base facilities has been awarded to Daniel, Mann, Johnson & Mendenhall and Associates, a joint venture consisting of Daniel, Mann, Johnson & Mendenhall, architects and engineers (Los Angeles); the Rust Engineering Company, engineers and constructors (Pittsburgh, Pa.); the Leo A. Daly Company, architects and engineers (Omaha, Nebr.); and Mason & Hanger-Silas Mason Co., Inc., engineers and contractors (New York, N. Y.).

Already under construction at Vandenberg Air Force Base at Lompoc, Calif., is the multi-million-dollar Operational System Test Facility. According to S. Kenneth Johnson, project manager for the joint venture, "This project will provide the only full-scale testing facility for the complete weapon system."

The TITAN facilities, like the missile itself, are said to represent an entirely new concept in U.S. missile base design. The first of the TITAN operational bases is programmed for Lowry Air Force Base in Colorado. Cost estimates are in the neighborhood of $50,000,000.

Conversion to Metric System Is Studied

The desirability of conversion in the U.S. to the metric system of weights and measures is being considered by a committee of the American Geophysical Union under chairmanship of Floyd W. Hough, M. ASCE, consulting engineer of Washington, D. C.

The plan is to promote conversion over a full generation, 33 years, so that people can be taught the metric system through their entire school and early professional career before use becomes mandatory. The British system would be taught, of course, but the emphasis would be reversed. In the long transition period those not familiar with the metric system would retire and the new dimension would gain gradual use in industry and commerce.

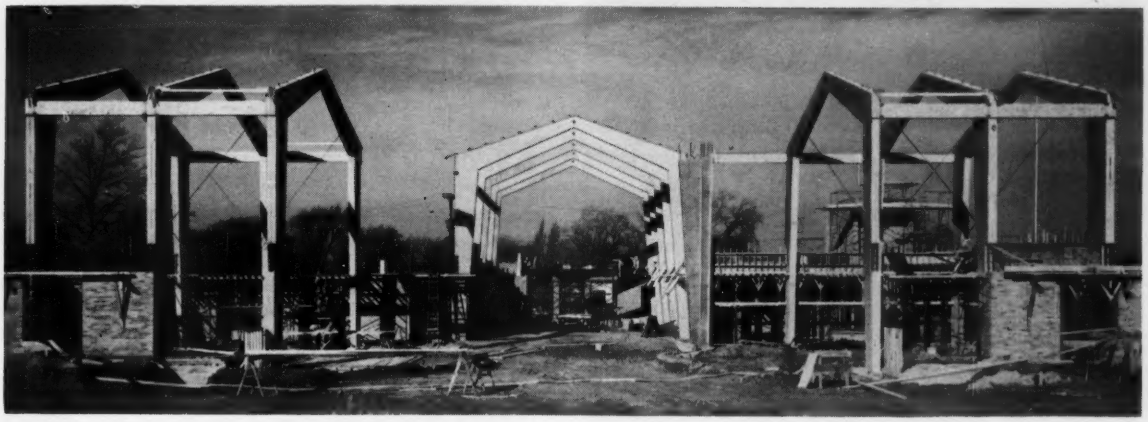
The Geophysical Union asks that interested persons fill out and return the accompanying questionnaire. In addition, interested persons are requested to write as fully as they like on the metric system outlining problems, and solutions if possible, of conversion. Communications should be addressed to the Executive Secretary, American Geophysical Union, 1515 Massachusetts Avenue N. W., Washington 5, D. C.

Metric System Questionnaire

You are invited to participate

What is your field of professional interest....
What percentage of units used in your work is Metric.... British.... Other....
Would conversion to metric units be advantageous to you Yes.... No....
Should the centigrade system for temperature be adopted Yes.... No....
How many years should be allowed for conversion to metric 10.... 20.... 30.... 40.... 50.... Longer....
Who should sponsor a study of this problem? Professional Societies.... Educational Institutions.... Industry.... Government....
How should the study be financed....
Will you help? Financially.... As an adviser....
Mail to American Geophysical Union
1515 Massachusetts Avenue, N.W.
Washington 5, D. C.
Additional remarks of any length are welcome.

These soaring two-unit precast concrete arches are 36′ high at mid-point and 42′ wide.



PRECAST CONCRETE ARCHES

form basic structure for new church

Lehigh Early Strength Cement concrete is poured in arch form at Goodstone Mfg. Co. yard. Completed arches were trucked 5 miles to job site.

Three of the four cranes required to position the arches. Note two workmen securing joint between 11½ ton arch halves.

• The new St. Ambrose Roman Catholic Church of Rochester, N. Y., with its eleven precast structural concrete arches, is another example of the growing trend toward precast concrete in modern construction.

The arches, each higher than a 3-story building and weighing 23 tons, were cast in two sections at the Goodstone Mfg. Co. plant.

In precasting these arch units, the manufacturer used Lehigh Early Strength Cement for maximum efficiency and economy. For example, forms were stripped and ready for reuse in 18 to 24 hours. And a faster production schedule cut labor costs an estimated 30%.

This is typical of the advantages of Lehigh Early Strength Cement in modern concrete construction.

Architect: Sanford Shanley, New York, N.Y.

Associate Architect: Raymond Ashley, Rochester, N.Y.

Consulting Engineers: Severud-Elstad-Krueger & Assoc., New York, N.Y.

General Contractor: Frank G. Maggio & Bros., Rochester, N.Y.

Manufacturer of Precast Arches: Goodstone Mfg. Co., Rochester, N.Y.

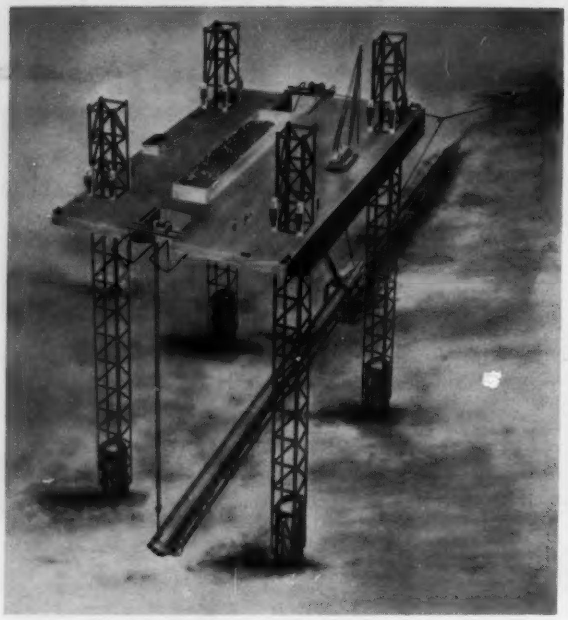
• LEHIGH EARLY STRENGTH CEMENT

• LEHIGH MORTAR CEMENT

• LEHIGH PORTLAND CEMENT

• LEHIGH AIR-ENTRAINING CEMENT

LEHIGH PORTLAND CEMENT COMPANY
ALLENTOWN, PA.



Offshore Platform Lays

Large Sewer Pipe in Ocean

Mobile offshore platform performs spectacular feat of laying six miles of record-size concrete sewer pipe in ocean water up to 200 ft deep off Los Angeles Hyperion Treatment Plant. Here it assembles the 12-ft-dia pipe weighing almost 400 tons per linear foot. The rig "walks" the ocean floor by jacking down the platform on legs until the entire unit is floating. Then it winches itself to the next position and re-elevates. The $20 million sewer-pipe job is being handled by Hyperion Constructors, a joint venture of Raymond International Inc. (sponsor), DeLong Corp., Healy-Tibbitts Construction Co., Peter Kiewit Sons' Co., Macco Corp., and Tavares Construction Co. The contract is with the Los Angeles Board of Public Works.

N. G. Neare's COLUMN

R. ROBINSON ROWE, M. ASCE

"I simply," begged Joe Kerr, "must have more equations!"

"How many more?" asked the Guest Professor, with half a promise.

"Lots, but even one might help. Identifying the unknowns by

$$\begin{array}{c} 6 \\ A\ K\ L\ E \\ J\ I\ M \\ B\ O\ N\ D \\ C \end{array}$$

which is to be magic by making all rows of four add to 27 when filled with the numbers 1 to 13, I wrote:

$$\begin{aligned} 27 &= 6 + B + J + K \\ &= 6 + D + L + M \\ &= A + E + K + L \\ &= A + C + J + O \\ &= B + D + N + O \\ &= C + E + M + N \\ 85 &= A+B+C+D+E+J+K+L+M+N+O+I \end{aligned}$$

The last equation less half the sum of the first six told me that $I=10$, so I still have six equations in 11 unknowns and need five more. Ironically, while I was looking for more equations, Fay, that's my wife, wrote the numbers on 13 checkers and fooled around until she found the answer

$$\begin{array}{c} 6 \\ 2\ 4\ 13\ 8 \\ 5\ 10\ 7 \\ 12\ 11\ 3\ 1 \\ 9 \end{array}$$

But I want to do it scientifically."

"The scientific way," prompted Cal Klater, "is to use an electridiotic computer, trying systematically the 39 916 800 combinations of 11 numbers in 11 sink-holes. This can be greatly simplified by dealing with foursomes, adding to 27 and noting that there are only 19 combinations like 13+11+2+1 adding four of the 11 numbers to 27, and only 10 like 13+7+6+1 which can be used for rows thru the upper vertex where a 6 is specified.

"Next note that these foursomes are used three at a time, like $A+K+L+E$, $B+O+N+D$ and $6+J+M+C$. There are only 23 ways of grouping the 29 combinations into three independent foursomes, like 13+8+4+2, 12+11+3+1 and 9+7+6+5. If these 23 groups were fed into the electridiotic computer, the blind trials would be reduced to 158 976.

"Better yet, suppose we pick two of the ten combinations with the number 6 for the rows $6KJB$ and $6LMD$. There are only 17 independent pairs and just 6 orders for each row, making 612 arrays, each of which fixes

$$C=21-J-M$$

If this is an acceptable value for C, there will be left four numbers for four unknowns (A, E, N and O) connected by three equations. Any of four choices for one unknown fixes the others, so that the computer would have only 2,448 trials at the most.

"Less idiotically, I hope, Joe could get by with fewer trials, knowing that 12 and 13 can't be on the same row, that $J+M$ can't exceed 20, that C will be unacceptable half the time, and that one trial will suffice instead of four for the last step. Thus, for the trial leading to Fay Kerr's solution, $C=21-5-7=9$, and $A+E=10$; $O+N=14$; and $A+O=13$. With only 2, 3, 8 and 11 available, the solution is obvious."

"And I can add," said Professor Pewter, "that there are 48 solutions to shoot for, so you should hit one in 13 careful shots. Now for a final sequel, with more equations for Joe, find an array with 6 rows of four adding to 27 and the 6 groups like $AJKI$ adding to 27, using the numbers 1 to 13 and putting the number 6 anywhere you like."

[*Cal Klaters were John A. Tweed, Luisi Anunz (Mmes E. Niguea and Robert E. Craig II), Thatchrite (Guy C. Thatcher), G. Nyuss (Robert M. Dodds), Julian Hinds, Emerson J. Boyd Jr., Walter J. Tudor, and Keith Jones, several of whom and William R. Osgood noted that 41 and 51 should be 4I and 5I in January's equations. Guest Professor Kum Pewter is Walter Steinbruch. Also acknowledged are slightly late solutions of the December problem from Donald Thayer, Rudolph W. Meyer, William Mendenhall Jr., Luisi Anunz, Merle A. Ewing, German Gurfinkel and Rudolf Hertzberg.*]

Allis-Chalmers Acquires S. Morgan Smith Company

Purchase of the S. Morgan Smith Company by the Allis-Chalmers Manufacturing Company was completed on January 28. The York, Pa., firm and its subsidiaries will operate as Allis-Chalmers' newly created Hydraulic Division within its Industries Group. Beauchamp E. Smith has been named general manager of the new division, which will be devoted to the design and fabrication of a complete line of hydraulic turbines and accessories; pumps; valves for industrial, waterworks, and power applications.

MODEL DTM-47 / SPECIFICATIONS

SEAMAN-ANDWALL SELF-PROPELLED TRAV-L-PLANT (Diesel-Powered — With Volumetric Meter)

• Exclusive mixing action of the adjustable-depth rotor corrects segregation in the base. The binder — either bitumen or water — is applied by the spray bar directly into the material to produce a uniform mixture.

• Application of binders is accurately controlled by the metering system, and is simultaneous with mixing action. Complete stabilization in one continuous operation.

• The spray bar is positioned at the most efficient mixing point just ahead of the rotor. It applies bitumen or water directly into the mix and eliminates surface run-off or migration of bitumen — or evaporation in the case of water.

• Positive mix is obtained by accurate metering system which automatically controls and records total binder gallonage used, gallons per minute used and feet per minute covered.

MODEL 5620 / SPECIFICATIONS

SEAMAN-ANDWALL 7-20 TON PNEUMATIC COMPACTOR (Gasoline or Diesel-Powered)

• New "straight-down" pressure principle made possible by front wheel drive offers the best possible compacting efficiency. Surface shear, scuffing, material displacement is eliminated . . . even in turning.

• Easy to operate and extremely maneuverable — can make a full 180° turn on an 18-foot road. Simple levers control both the power steering and the automatic transmission, as well as the auxiliary 2-speed transmission.

• Complete flexibility in operation—4 forward speeds from 1 to 20 MPH — 2 reverse speeds from 2 to 9 MPH — along with an extra-low center of gravity make this one of the most practical and versatile of all road rollers.

• Only roller built with watertight ballast compartment.

MODEL HY-4 and HY4-6 / SPECIFICATIONS

SEAMAN-ANDWALL CENTURY SPREADERS (Dual Purpose)

• Adaptable to all spreading requirements — spreads any aggregate or combination of aggregate up to 1½ inches including wet, stock-piled material.

• Can be used the year around — conversion from a spinner operation to a sealcoat unit is quick and easy. Powered screen agitator prevents bridging or channeling.

• Accurately controlled application — width of spread with the spinner is adjustable from 2 to 40 feet . . . with the sealcoat tray, from 2 to 9 feet.

• Completely automatic — width of material to be spread is hydraulically cab-controlled, operated by truck driver alone.

SEAMAN-ANDWALL TRAV-L-PLANT and PULVI-MIXER

In Bituminous Stabilization

- Coats aggregates thoroughly and uniformly
- Achieves plant mix quality at road-mix cost
- Provides a superior mix with asphalts, emulsions, oils and tars
- Blends out "rich" and lean areas to uniformity
- Blends coarse and fines to a homogeneous mix
- Reclaims old, worn-out bituminous pavements
- Aerates solvents quickly
- TRAV-L-PLANT prevents binder migration

In Soil-Cement Stabilization

- Achieves optimum moisture accurately
- Provides uniform mix of cement and aggregates or soils
- Mixes a mile a day of 24 foot road
- Leaves mix shaped to final crown and grade, ready for compaction
- Pulverizes clods of clay
- Dries over-wet soils
- TRAV-L-PLANT prevents excessive moisture evaporation

In Salt, Calcium Chloride or Lime Stabilization

- Achieves a perfect mix generally in one operation
- Achieves a dense, tight, water and frost resistant base
- Mixes and interlocks aggregates; fills voids with fines
- As in all mixing operations, greatly reduces costs
- Provides uniform distribution of the water increment
- New work or reconstruction of old surfaces equally simple

In Water-bound Macadam Construction

- Produces a tightly knit base in one operation superior to old fashioned hand placement and Brooming-in of fines
- Large daily production
- Fractional production costs
- Keys and interlocks crushed stone, eliminates voids or pockets
- Provides a high type of base or sub-base at minimal cost

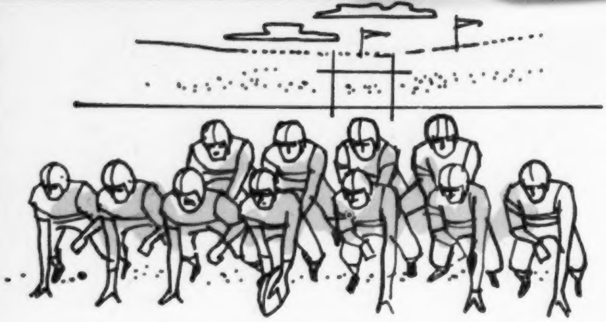
LITHO IN USA D&J-58

The Seaman-Andwall TRAV-L-PLANT mixing for a salt stabilization of a county gravel road in Colorado.

Photo was taken from the Seaman-Andwall 5620 (7 to 20 ton) Pneumatic Compactor which followed immediately behind the Mixer. Notice the thorough and uniform blending and placement of materials in the mix.

The Seaman-Andwall 5620 Pneumatic 7 to 20 ton Compactor rolling out a high type of bituminous mix. Because drive is direct to front tires, the compaction force is straight down which eliminates the usual pushing action that otherwise causes surface shear, scuffing, material displacement or other disturbance of material. The Compactor is able to make a full 180° turn in a 18 foot roadway. Unusually low center of gravity provides operator safety even on 3 to 1 slopes.

Spreading for a salt stabilization with the Seaman-Andwall Century Spreader (Model HY-4). Chips, pea gravel and aggregates up to 1½ inches can be similarly spread with the channeled tray for sealcoat work. The tray is removable and a hydraulically operated spinner is quickly substituted for wide spreading of sand, chlorides and similar materials in ice control work. The Century HY-4 is completely controlled by one man — the truck driver — from the truck cab.



MODEL DTM-47 / SPECIFICATIONS

SEAMAN SELF-PROPELLED DIESEL-POWERED TRAV-L-PLANT WITH VOLUMETRIC METER

ENGINE: General Motors 4-cylinder diesel. Model 4057C, 138 HP at 2000 R.P.M.

ROTOR: MFR-A type, 7-foot mixing width. All cast malleable tine plates, friction driven with 10-inch clutch discs. 27-inch tine circle. Friction drive principle enables any pair of tine plates to slip independently when encountering obstructions.

TINES: "SC" or "Bevel Edge." Heat treated alloy steel for wear resistance.

SC tines are standard equipment and are furnished unless Bevel Edge are specified. Both types are interchangeable. The SC hook type tine is recommended for working heavily compacted surfaces, large aggregate, and bituminous reclamation. Provides maximum cross-mix of material. The Bevel Edge is recommended for mixing of loose soils, fines, or small aggregate. Produces fine pulverization and is unexcelled for additive processing.

SCARIFIER: Underbody type, hydraulically operated.

CHASSIS: 10-inch steel channel construction.

HYDRAULIC SYSTEM: Positive displacement engine driven pump with conveniently located manually operated control valves.

FUEL TANK: 53 U. S. Gallon capacity. Welded steel construction, rubber mounted. Equipped with filler strainer, shut-off valve and fuel gauge.

TIRES: Front, 10.00-20. Rear, 15.00-34. (Other sizes optional.)

WHEEL BASE: 118" long. Turning radius. 20 feet.

STEERING: Ross cam and lever automotive type. Power steering optional.

BRAKES: Dual master cylinder, hydraulically operated service brakes on rear wheels. Brake pedals may be operated individually or simultaneously. Parking brake.

DRIVE: 5-speed main and 2-speed auxiliary transmissions. Timken Heavy Duty rear axle, differential and final drive.

BINDER APPLICATION EQUIPMENT: Wisconsin engine Model VG4DU—Warner Transmission. Roper model 3600-6RV pump with 200 G.P.M. capacity, equipped with relief valve and shut-off valves. Fifth wheel tachometer indicating F.P.M., volumetric meter recording total gallonage and electric tachometer indicating G.P.M. 7-foot spray bar with 3-way valve. 3" dia. x 16 foot truck-to-pump suction hose. Strainer assembly. Equipment designed to handle bitumen or water.

DIMENSIONS: Length, 22'3". Width, 7'10". Height, 8'0".

WEIGHT: 13,550 lbs.

ROTOR SPEED: 215 R.P.M. at 2000 R.P.M. Engine speed. 2-speed rotor drive, 215 or 350 R.P.M.

RATE OF TRAVEL AT 2000 R.P.M. ENGINE SPEED:

Main Trans. Gear	Aux. Trans. Low Range		Aux. Trans. High Range	
	F.P.M.	M.P.H.	F.P.M.	M.P.H.
5th	679	7.8	1242	15.0
4th	561	6.4	1034	11.9
3rd	298	3.3	545	6.2
2nd	166	1.9	303	3.4
1st	97	1.0	175	2.0
Rev.	164	1.9	298	3.3

Specifications subject to change without notice.

MODEL 5620 / SPECIFICATIONS

SEAMAN-ANDWALL SELF-PROPELLED GASOLINE OR DIESEL-POWERED 7-20 TON PNEUMATIC COMPACTOR

ENGINE: 226 Cu. in., 75 H.P. 6 Cylinder Continental Gasoline Engine equipped with electric starter.
Continental HD260 Diesel Engine. Brake HP at 2000 RPM, 59. Max Torque at 1100 R.P.M., 188 Lb. Ft.

TRANSMISSIONS: (Gasoline powered) Warner Torque converter, Warner automatic transmisison, Fuller auxiliary 2-speed.
(For Diesel only) Long converter, Funk Revers-o-matic. Warner T-9, 4-speed transmission.

SPEEDS: (Gasoline powered) Forward—2 speeds from 1 to 20 MPH. Reverse—2 speeds from 2 to 9 MPH.
(For Diesel only)
Forward — 4 speeds; 2.3 MPH to 15.9 MPH.
Reverse — 4 speeds; 2.3 MPH to 15.9 MPH.

FUEL TANK: 40 Gallon Capacity.

CLUTCHES: 16 clutch facings of 8" diameter located in front wheel roll. Each wheel is independently driven with 2 clutches to prevent scuffing of the rolled surface; the clutch pressure being hydraulically adjusted at the operator's platform for various rolling conditions.

BRAKES: Automotive type hydraulic brakes on rear axle. Mechanical brake on front drive line.

STEERING: Through a "constant" torque mechanism permitting 180° travel with a 5" diameter hydraulic cylinder. Turns completely in 18-foot roadway.

DIMENSIONS: Wheelbase, 132"; Overall length, 211"; Overall width, 92"; Rolling Width, 92"; Ground clearance, 11"; Overall height, 71".

WHEELS: Front Drive Roll, 8 wheels; Rear Roll, 9 wheels.

TIRES: 7.50-15 smooth tread, 6 ply, 8" wide compaction type. Operating tire pressure — 35 lbs. to 90 lbs.

SPRINKLER SYSTEM: 360 gallon capacity — provides spray on each tire, front and rear. Pump-driven sprinkler system standard equipment.

BALLAST: Water or sand or both.

ELECTRICAL SYSTEM: 6 volt system, includes sealed beam headlights, and taillight (12 volt for Diesel).

WEIGHTS:

Gross Weight — Empty		With Ballast Water	With Ballast Dry Sand
Front	10,000	14,940	19,770
Rear	5,000	16,800	22,240
Total	15,000	31,740	42,010

Specifications subject to change without notice.

MODEL HY-4 and HY4-6 / SPECIFICATIONS

SEAMAN-ANDWALL CENTURY SPREADERS

MATERIAL: Positively spreads any aggregate or any combination of aggregate up to 1½ inches including wet, stockpiled material. Powered screen agitator prevents bridging and channeling. A lug type auger reduces coagulated, crushable material to spreading size.

POWER: Hydraulically operated from power take-off of truck engine. Needle bearing pump, motor and "U" joints supplied in complete premachined universal mounting kit. Hydraulic system safety relief valved at twice the operating pressure to prevent unit damage from foreign non-crushable material.

ADAPTABILITY: May be mounted on any standard truck (6½ ft. and over). Spreader trough rests against the inside of truck tail gate. Tail gate chains hold unit securely in place. No need for welding or bolting to dump body. No necessity for removing and storing tail gate.

SPREAD WITH SPINNER: Operation: Completely automatic. Push button controlled by driver from truck cab. Spreader gates automatically opened and closed when unit is engaged or disengaged. Speed of spinner instantly adjustable from 0 to maximum from truck cab to regulate width of spread. Spreads with equal efficiency while operating in reverse or forward.

Width of spread: 24 inches to 40 feet.

Depth of spread: From minimum of 100 lbs. of chlorides per running mile of roadway, for ice and dust control, to a maximum amount of aggregate required in applying a single pass sealing or armor coat finish.

Direction of spread: Simple adjustment places material to the left, right, ahead or to the rear of truck at any desired direction.

Angle of spread: Spinner remains level to roadway, angle of dump body discharging full or almost empty load does not alter level position of rotating spinner.

SPREAD WITH TRAY: Adaptability: Spinner can be detached and Seal-Coat Tray accessory positioned for service within 15 minutes.

Control: Driver-operated automatic flow control lever on truck dash instantly starts and stops material flow. Precise engineering of calibrated tray provides width of spread from 2 to 9 feet, and any desired depth with perfect uniformity and sharp cut-off.

TROUGH CONSTRUCTION HY-4: Welded heavy gauge reinforced steel. Spreader width adjustable for any dump body with 6½' or more inside width. Depth, 14". Height, 32".

TROUGH CONSTRUCTION HY4-6: Same as above — for 6' truck body.

BEARINGS: Agitator and stabilizer bearings permanently sealed. SEALMASTER prelubricated self-aligning ball type.

GEAR BOX: ¼" wall cast iron case, sealed ball bearings.

HYDRAULIC COMPONENTS: Century built; guaranteed for one full year.

SHIPPING WEIGHT LESS TRAY: Approximately 580 lbs.

WEIGHT — TRAY ACCESSORY: 130 lbs., including special vibrator assembly.

Specifications subject to change without notice.

DECEASED

Carl E. Arnold (A.M. '27), age 75, retired engineer of South Pasadena, Calif., died in Santa Monica on January 29 Mr. Arnold was in the employ of Los Angeles County from 1924 until his retirement five years ago, and was county engineer from 1947 to 1951 He continued as county representative on the Los Angeles Regional Water Pollution Control Board until his final illness forced his resignation.

Robert J. Bassett (A.M. '04), age 85, for many years superintendent in charge of construction and general superintendent for Ebasco Services, Inc., of New York City, died recently. Mr. Bassett, in the mid 1930's, was general superintendent of construction for the Tarrant County (Texas) Federal Emergency Relief Administration, and construction engineer for the Texas Centennial Exposition held in Dallas in 1936.

Allan H. Baxter (M. '39), age 72, partner in the Buffalo, N. Y., industrial engineering firm, A. E. Baxter Engineering Company, died in Buffalo recently. The company, which had been established by his father sixty years ago, specialized in the design of grain processing plants. Mr. Baxter had an engineering degree from Cornell University.

Harwood Beebe (M. '27), age 74, head of the Harwood Beebe Company, an organization of municipal engineers, of Spartanburg, S. C., died there on December 15. Mr. Beebe, a civil engineering graduate of the North Carolina State College of Agriculture and Engineering, founded the firm in 1916. He had charge of the design and supervision of construction of water works, filtration plants, sewer systems, sewage disposal plants, street paving and other municipal improvements throughout North Carolina. He had also been engineer for the Spartanburg Airport.

Ronald A. Boesel (J.M. '57), age 27, a civil engineer for the Southern Pacific Railroad at Portland, Ore., died recently in an accident. Mr. Boesel graduated from the Oregon State College School of Engineering in 1957, and had served for two years in the Army.

William Harris Bosier (M. '21), age 87, of Kansas City, Mo., died there on December 31. Mr. Bosier attended the University of Missouri and was admitted to the Missouri Bar in 1900, but later studied engineering and specialized in the construction of deep foundations for bridges. During his long career he was associated with the Missouri Valley Bridge and Iron Works Company and the Kansas City Bridge Company, and had been in charge of the foundation work

(Continued on page 106)

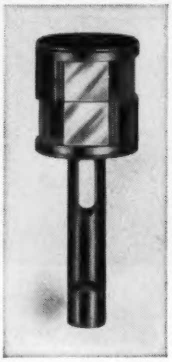
Some Ideas

for your file of practical information on surveying
from
KEUFFEL & ESSER CO.

An anonymous Persian once said: "Luck is infatuated with the efficient." In line with this bit of good, dry wisdom, we present five items that, in their measure, will step up surveying efficiency . . . by permitting faster work, by promoting greater accuracy, or by doing both. For example . . .

The New K&E Double Right Angle Prism

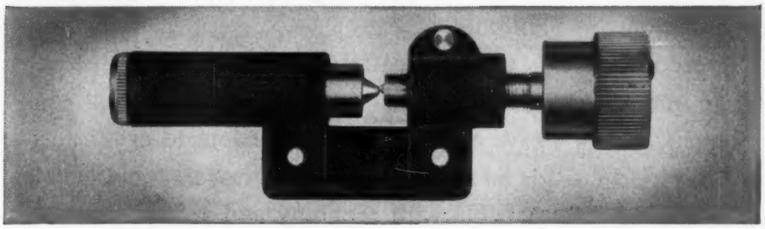
This simple, hand-held instrument belongs in every surveyor's kit. It bends the line of sight exactly 90° to left and right, so that you can quickly establish a right angle to your position between any two points — without the bother of setting up a transit. This can save you much time and effort when staking out small areas or laying out squares for contouring.



Objects straight ahead can be sighted clearly through a slot in the handle, even when they are at a steep angle above or below your position. Actually, the new Double Right Angle Prism is an improved edition of an earlier K&E model. Tests show that it's much more accurate. The prisms are much larger . . . points are picked up more quickly.

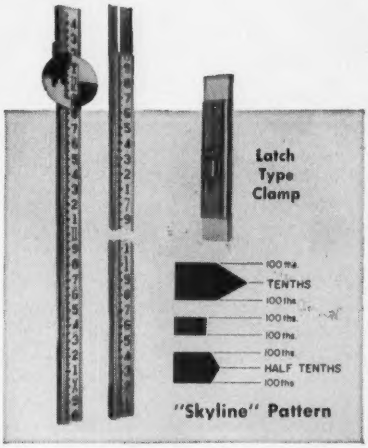
High and Low Gear Tangent Settings

Exact aiming and precise vernier settings are fast, smooth and easy with the new



K&E 2-Speed Tangent Screw. Its two sets of gears control rough adjustments separately, with one screw. Simply by reversing the tangent screw, you swing into "low gear" once the rough sighting has been made. Then, with the screw operating at a slower, finer ratio (4 to 1), you have firm, positive control of final settings. Hesitation and delay are eliminated, with considerable saving of time and temper for the whole field party.

The upper motion of every new K&E PARAGON® Transit is fitted with a 2-Speed Tangent Screw, as standard equipment. The new control may be specified for the other two motions as well. If you already have a PARAGON Transit (not more than 5 years old), you can order these time-savers individually, and install them yourself.



Rigid as a Steel Column

Here are two outstanding K&E features offered by the recently-developed Detroit Leveling Rod. The rod is made in three sections. Each of these is joined by an exclusive locking device — a latch-type clamp on a steel brace, drawing the sections together in rigid contact. When erected to its full 12.5-foot height, the Detroit Rod is as solid as one continuous bar. There is no wobbling or binding at the joints. Even habitual skeptics have called this "a revolutionary advance" over conventional locking methods. Another important feature: the new "Skyline" graduations, developed by K&E to make fast but accurate readings possible at greater distances, with less eyestrain. The distinctive pattern shows tenths of a foot, half tenths and hundredths — sharply on a clean, white background. Every Detroit Rod is furnished with a strong, mildew-resistant canvas bag, partitioned to hold the three sections. The bag is only 4'6" long.

New Tape Thermometer Snubs Air Temperature

On a winter afternoon, when the mercury can drop from a balmy 50° at noon to 20° at 4 pm, a 100 foot steel tape can shrink as much as 1/20 of a foot. A reliable tape thermometer assures accurate measurements by showing actual tape temperature — often 20 to 30° higher or lower than that of the air. K&E designed this new

tape thermometer so that the bulb may be *clamped* tightly against the tape surface. It reports the *tape's* temperature, not the air's. Above-zero readings appear in black, below-zero in red. The instrument complies with rigid Government specifications.

Red and Yellow and Seen All Over

For years, surveyors have protected life, limb and property by painting tripod legs in loud colors. Now, all K&E wide-framed tripods are available *pre-painted* in high-visibility yellow, with a bright red stripe. You can throw away your paint brush!

All these products may be seen and had at your nearest K&E dealer. Stop in and see them. Or simply clip and mail the coupon below...

KEUFFEL & ESSER CO., Dept. CE-3, Hoboken, N. J.

I'd like to know more about:

- ☐ K&E Double Right Angle Prism
- ☐ 2-Speed Tangent Screw
- ☐ New K&E Tape Thermometer
- ☐ Detroit Leveling Rod with "Skyline" Graduations
- ☐ New 2-Color Tripods

Name & Title ______________________

Company & Address ______________________

______________________ 1624

Non-ASCE Meetings

American Chemical Society. One hundred thirty-fifth national meeting will be held in Boston, Mass., April 5-10. Information available from the Society, 2 Park Avenue, New York 16, New York.

American Institute of Chemical Engineers. Thirty-ninth national meeting sponsored by the New Jersey and North Jersey sections in Atlantic City, N. J., March 15-18. Further information from Raymond C. Mayer & Associates, 36 West 46th Street, New York 36, New York.

American Welding Society. Fortieth Annual Technical Meeting and Welding Exposition at the Hotel Sherman, in Chicago, Ill., April 6-10. Advance tickets and information available by writing to Mr. H. H. Comstock, c/o National Cylinder Gas, Division of Chemetron Corp., 840 N. Michigan Avenue, Chicago 11, Ill.

Building Research Institute. Eighth annual meeting at the Penn-Sheraton Hotel, in Pittsburgh, Pa., April 7-8. Additional information may be obtained from Mr. Harold Horowitz, Technical Secretary, BRI, National Academy of Sciences, 2101 Constitution Avenue, Washington 25, D. C.

Engineers Joint Council. 1959 Nuclear Congress at the Public Auditorium in Cleveland, Ohio, April 5-10. EJC is the coordinating agency for the Congress. For additional information write EJC, 29 West 39th Street, New York 18, N. Y.

Illinois Institute of Technology. Twenty-first American Power Conference at the Hotel Sherman in Chicago, March 31 and April 1-2. For further details write R. A. Budenholzer, Conference Director, Mechanical Engineering Department, Illinois Institute of Technology, 3300 Federal Street, Chicago 16, Ill.

National Military-Industrial Conference. Fifth Annual Conference on the Soviet Challenge at the Palmer House in Chicago, Ill., April 6-8. Registration and additional information available from the National Military-Industrial Conference, 140 South Dearborn, Chicago 3, Ill.

Purdue University. Fourteenth Purdue Industrial Waste Conference sponsored by the School of Civil Engineering at the Purdue Memorial Union Building, Lafayette, Ind., May 5-7. Hotel reservations can be made at the Purdue Union Club, Fowler Hotel, Cedar Crest Hotel and Morris Bryant Hotel in Lafayette.

Rand Corporation. Protective Construction Symposium will be held at the Rand Corporation, in Santa Monica, Calif., March 24-26. For further details write Rand Corporation, 1700 Main Street, Santa Monica, Calif.

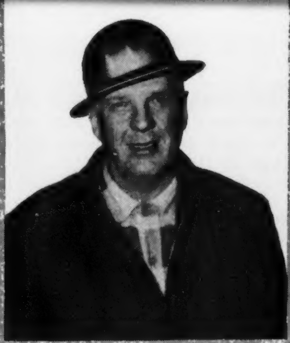
University of North Carolina. Eighth Southern Municipal and Industrial Waste Conference, at the University in Chapel Hill, N. C., April 2-3. The $15 registration includes attendance at all the sessions, Proceedings, two luncheons and the social hour and banquet. Accommodations may be obtained by writing directly to the Carolina Inn or the University Lodge Motel, Chapel Hill, N. C.

Society of American Military Engineers. Thirty-ninth annual meeting, Washington, D. C., May 18-19. Information from the SAME, 808 Mills Building, Washington, D. C.

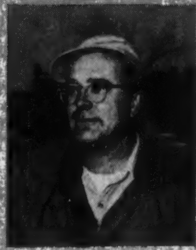
Positions Announced

City of San Diego. Immediate appointment for an Assistant Sanitary Engineer, $587-$647 per month. Position involves assisting in the planning, designing, drafting and specification writing for sewage treatment plants, pumping stations and sewage systems. Applicants must have the equivalent of a degree in civil engi-

(Continued on page 120)



"We build Sewage Treatment and Water Filtration Plants"



"I build Industrial and Commercial"

"We are building Bridges and Overpass Structures"

"Schools are our specialty"

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ALL are *Profitably* solved
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INFORMATION Send us a set of plans for a job you're bidding. From these, our Engineering Department will tell you:

1. Total form contact area in square feet
2. Total square feet of forms required
3. Number of ties required
4. Forming recommendations

PLUS a complete proposal, advising what it would cost to rent the complete UNI-FORM "Package" for the job.

PRODUCT A complete, ready-to-use concrete forming "package" . . . tailored **(not adapted)** to handle your specific job—on a *rental* basis. Forms in the most efficient sizes, Ties, Tie Keys and accessories will be included in the proposal.

SERVICE When you rent UNI-FORM Panels, you get, at no extra cost, the services of Universal Engineers—experienced concrete forming specialists—who provide complete job details, job-site service.

Contractors all over the country depend on UNI-FORM Panels and Universal Engineering assistance to help keep their concrete forming on a profitable basis. Why not investigate the UNI-FORM Rental "Package" Plan? There's no obligation. Write for details . . . send us your plans.

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Universal Form Clamp Co. of Canada, Ltd., 226 Norseman St., Toronto, Ontario

Deceased

(Continued from page 100)

on a number of Mississippi and Missouri River bridges.

William Nelson Brown (M. '12), age 85, president of the W. N. Brown Company, Washington, D. C., died at his home there on January 12. A pioneer in the use of aerial photography for mapping, Mr. Brown improvised his own techniques for mapping the Mississippi River from St. Louis to St. Paul for flood control projects long before modern methods of photogrammetry had been developed. Mr. Nelson established his firm in 1908. He was a graduate of Virginia Military Institute.

Eugene E. Halmos (M. '20), age 81, associate partner and design consultant in the New York firm of Tippetts-Abbett-McCarthy-Stratton for the past ten years, died in Manhasset, L. I., on February 1. Mr. Halmos, born and educated in Hungary, began his career in the U. S. with Barclay, Parsons and Klapp in 1912, remaining with that firm and its successors for thirty-five years. During his fifty-year career he designed ports and harbors, water resources and hydroelectric projects, subways and tunnels. Mr. Halmos was author of technical articles and a contributing editor of the American Civil Engineers handbook.

E. E. Halmos

George Samuel Hill (A.M. '09), age 82, consulting engineer, of San Francisco, Calif., died there recently. Early in his career Mr. Hill designed the roof trusses for the Redwood City Court House in California and Carpenters Hall at Philadelphia, Pa., and the combination bridge over the Russian River at Largo, Calif. Prior to entering private practice he served as assistant engineer with the California State Railroad Commission, and later was structural engineer with the Bureau of Building Inspection at San Francisco.

Joseph Francis Hughes (A.M. '38), age 64, construction superintendent for Ebasco Services, Inc., New York City, died recently. Mr. Hughes graduated from the University of Maine with a civil engineering degree in 1922. A year later he became connected with the Allentown, Pa., office of the Phoenix Utility Company, where he remained until 1940, first as resident engineer and later as general superintendent. He had been with Ebasco since 1940.

Saens Wirt LaLance (M. '44), age 66, design engineer for the West Virginia State Road Commission at Huntington, died recently. Prior to joining the Road Commission in 1941, he was special city engineer for Huntington. He had also been in consulting practice in Huntington. Mr. LaLance graduated from Marshall College in Huntington.

Fred Justin Lewis (M. '29), age 68, dean of the Vanderbilt University School of Engineering, Nashville, Tenn., died there on January 4. He had been on the Vanderbilt faculty since 1925 and dean of the engineering school since 1933. One of Dean Lewis' many contributions to the university was the acquisition of its summer surveying camp. He was a 1914 civil engineering graduate of the University of Maine and had an M. S. from Pennsylvania State College. He taught at Penn State and at Lehigh University before going to Vanderbilt.

Clarence E. Long (M. '21), age 75, consulting engineer of Greensburg, Pa., died there on December 12. A graduate of Bucknell University in 1908, Mr. Long joined the Jones and Laughlin Steel Corporation in Carnegie, Pa., the same year. After leaving Jones and Laughlin in 1913, Mr. Long established his own practice. For several years, 1910-1914, he taught at the Carnegie Institute of Technology in Pittsburgh.

R. M. McCrone (M. '21), age 73, former civil engineer for the Mississippi River Commission, died suddenly at Vicksburg, Miss., on December 16. Mr. McCrone was with the Corps of Engineers from 1928 until his retirement seven years ago, serving in the Montgomery, Ala., District office and in the Gulf Division Office at New Orleans before his assignment to the Mississippi River Commission. In his early career he had worked in the Philippines, Thailand, and Venezuela.

Tollef B. Monniche (M. '12), age 84, former engineer on the construction of the Panama Canal, died in Austin, Tex., on December 14. On the designing staff of the Isthmian Canal Commission from 1908 to 1917, Mr. Monniche designed the emergency dams for the Canal, one of the features that drew worldwide attention to the project. From 1917 to 1957 he lived on his coffee plantation at Lerida, Panama. He designed his own buildings and coffee processing machinery, making the place one of the outstanding coffee-producing plantations in Panama.

Percy M. Otway (M. '24), age 76, consulting engineer of London, England, died there on November 14. For twenty-six years Mr. Otway was supervising engineer for the Ministry of Transport and County Authorities in England responsible for the design and construction of major highways, airfields, runways and defense works. More recently he had acted as consulting engineer to Dominion governments and private industrialists. Mr. Otway, a graduate of the University of Bristol, England, invented an improved method of forming transverse,

(Continued on page 108)

Deceased

(Continued from page 106)

longitudinal and oblique joints in concrete structures.

Manuel Virgilio Patino (M. '57), age 57, engineer with Rader & Associates, of Miami, Fla., died recently while on an assignment for the firm in Panama. A citizen of the Republic of Panama, Mr. Patino, served for many years in the Ministry of Health and Public Works, and had been Minister of Public Works. A few years ago he acted as consultant for the Pan-American Division of the American Road Builders Association, coordinating the efforts of Latin-American countries in obtaining practical technical information for their road and highway programs. Mr. Patino was a 1929 graduate of Massachusetts Institute of Technology.

George W. Phillips (M. '44), age 64, chief engineer of the Alabama State Highway Department's Bureau of Maintenance at Montgomery, died recently. Mr. Phillips joined the Alabama State Highway Department in 1939 as a division engineer, becoming chief engineer of the Bureau of Maintenance in 1944. Mr. Phillips was a graduate of Alabama Polytechnic Institute.

Clayton L. Piper (A.M. '33), age 56, partner in the Toledo, Ohio, firm of Charles L. Barber & Associate, died November 12. In the employ of the City of Toledo for twenty-seven years, Mr. Piper became commissioner of harbors and bridges in 1936; commissioner of engineering in 1940; and Toledo's first commissioner of aviation in 1948. Entering private practice as a consultant four years ago, Mr. Piper helped design airfields and terminal facilities at Moissant International Airport, New Orleans, La., and airports in Portland, Ore.; Stockton, Calif.; Midland, Tex.; and Dayton, Ohio.

James Anderson Porter, Jr., (A.M. '57), age 37, civil engineer with the Nashville, Tenn., District of the Corps of Engineers, was killed in an airplane crash in east Tennessee on January 8. Mr. Porter had been with the Corps of Engineers since 1948. His previous assignments had been the Jacksonville, Fla., District and Washington, D. C., where he served on an Armed Forces special weapons project. Mr. Porter graduated from Vanderbilt University with a degree in civil engineering and served with the U. S. Air Force in Europe during World War II.

Carl Rohwer (M. '43), age 67, retired senior irrigation engineer for the U. S. Department of Agriculture's Agricultural Research Service, died in Fort Collins, Colo. on January 14. Mr. Rohwer retired four years ago after forty years of service with the Department at Colorado State University. An authority on many irrigation phases, he did original research in the fields of evaporation, canal seepage and linings, irrigation wells and

(Continued on page 110)

Deceased

(Continued from page 108)

pumps, and many types of flow measuring devices, and was author of numerous publications in his field. He was a graduate of the University of Nebraska and Cornell University.

Jack W. Sheetz (A.M. '47), age 54, since 1954 superintendent of public works for the City of Whittier, Calif., died recently. Immediately after graduating from Kansas State College in 1927, Mr. Sheetz joined the Illinois State Highway Department at Peoria, as a designer, and later was resident engineer in charge of major highway construction projects. Subsequently he worked as project engineer for the Michigan State Highway Department and the Missouri State Highway Department. He was first employed by the city of Whittier in 1944, as designer of the sewage disposal plant and additions to the city's water system.

William E. Whalen (M. '41), age 69, retired construction engineer with the Electric Auto-Lite Company, of Toledo, Ohio, died recently. Mr. Whalen was construction engineer from 1942 to 1956, the year of his retirement. Previously he had been assistant to the general superintendent of building construction and engineer in the planning and efficiency department of the Willys-Overland Company. Mr. Whalen received a B. S. in civil engineering in 1914 from the University of Vermont.

Henry Alexander Whitcomb (M. '51), age 61, chief, Operations, New England Division, Corps of Engineers, Boston, Mass., died October 30. Mr. Whitcomb was a member of the Corps for more than thirty-five years, serving at one time as head of the Rivers and Harbors Division for the New England area. He attended Rhode Island State College.

George Davis Williams (A.M. '35), age 56, partner in the Austin, Tex., consulting engineering firm of Julian Montgomery, died in an automobile accident recently. Earlier Mr. Williams had served the Texas Highway Department in Austin for ten years in various capacities. He received his B. S. and M. S. degrees in civil engineering from the Texas Agricultural and Mechanical College.

Russell Sherwood Wise (A.M. '14), age 76, of Russell S. Wise Associates, Passaic, N. J., died recently. Mr. Sherwood founded the firm which bears his name in 1950, after leaving the Passaic firm, Union Building and Construction Corporation, ending six years as chief engineer. Over the years he had served as chairman of the New Jersey State Traffic Commission; construction engineer with the Passaic Valley Water Commission; senior engineer with the New Jersey State Water Policy Commission; and consulting engineer to the Port of New York Authority, on the approaches to the Lincoln Tunnel.

News of Engineers

(*Continued from page 26*)

William T. Kellermann, until recently a lieutenant in the Civil Engineer Corps of the United States Naval Reserve, has been appointed field engineer with the Natural Rubber Bureau Road Research Laboratory at Rosslyn, Va. In his new capacity, Mr. Kellermann will work closely with state authorities. He is a specialist in the use of natural rubber and asphalt for surface treatment work.

James F. Beall, Jr., of Evergreen, Colo., announces the sale of his engineering and land planning practice. Mr. Beall will serve the successor firm, Beall and Keck, as a part-time consultant. He will spend his free time traveling and indulging his hobby of composing music.

Philip Abrams, until recently project engineer for James M. Montgomery, has been named an associate of Engineering-Science, Inc., of Pasadena, Calif. Mr. Abrams will assume the position of manager of the firm's Southern California production operations in charge of water and sewerage projects.

S. Charles Adams has become an instructor in civil engineering at the University of Connecticut's Hartford Branch, teaching descriptive geometry and statics and dynamics. Mr. Adams until recently was intermediate estimator for the Bechtel Corporation of San Francisco, Calif.

Samuel S. Baxter, commissioner and chief engineer of the Philadelphia Department of Water, has been named Philadelphia "Engineer of the Year." Prior to his present post, Mr. Baxter served the city of Philadelphia for many years in the former Department of Public Works. The honor comes to him for long and eminent service to the city.

Beaver Awards

Three Society members have received Beaver statuettes, a recently established West Coast award for outstanding achievement in the construction field.

L. J. Sverdrup

L. J. Sverdrup, president of Sverdrup & Parcel, of St. Louis, Mo. and a Major General in the Army Corps of Engineers, during World War II supervised construction of a chain of air bases which his company designed under contract with the U. S. Army Corps of Engineers. General Sverdrup is honored for achievements in civilian, military, and diplomatic fields.

Charles P. Dunn

Charles P. Dunn, since 1946 has been president and general manager of International Engineering Co., Inc. of San Francisco, Calif. In addition he is vice president and director of Morrison-Knudsen Company, a post to which he was appointed in 1942.

Ben Moreell

Ben Moreell, chairman of the Board of Jones and Laughlin Steel Corp., of Pittsburgh, Pa., is a Special Category winner. He is an Honorary Member of ASCE and retired Four-star Admiral. Admiral Moreell, former chief of the Navy Bureau of Yards and Docks and chief of the Engineers, tremendously aided the war effort by organizing the Seabees.

Beaver officers elected during the meeting include two ASCE members. **Edgar F. Kaiser,** president, Henry J. Kaiser, Co., Oakland, Calif., is the new vice president, and **J. P. Shirley, Jr.,** vice president, Gunther & Shirley Company, Sherman Oaks, Calif., the new secretary-treasurer.

New Publications

Home building standards . . . . Recommendations from all segments of the building industry have gone into an important new publication of the Federal Housing Administration, entitled "Minimum Property Standards for One and Two Living Units." The minimum property standards established by the FHA are aimed at obtaining the qualities considered necessary in the planning, construction, and development of a property that is to serve as security for an insured mortgage. The standards are not intended to serve as a building code; rather they deal with the many other aspects of design and use considered essential for mortgage insurance determinations. Copies of the 300-page publication may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., at $1.75 a copy.

Presenting technical papers . . . . A new reference manual of procedures required by technical societies and trade associations for the preparation and presentation of papers has been published by the Industrial Publicity Association. Prepared in cooperation with 36 leading technical societies (ASCE among them), the guide includes data on membership structure, principal meeting dates, subjects of interest, paper requirements, mechanics of contribution, policies on preprints and reprints. The reference—entitled "Technical Societies Guide"—may be purchased from the Technical Societies Committee of the I.P.A., Room 1616, 51 East 42nd Street, New York 17, N. Y. The price is $3.00.

Professional Engineer examinations . . . . Complete structural design examinations given by the State of New Jersey in December 1957 and June 1958 have been made available, with answers by Prof. Odd Albert, A.M. ASCE, of Brooklyn Polytechnic Institute. The answers are detailed, providing every step needed to a full understanding of how the solution is reached. Where more than one solution is possible, Professor Albert has supplied it. The sets, priced at $1.00 each, are available from the New Jersey Society of Professional Engineers, Trenton, N. J.

New welding symbols . . . . The first major change in welding symbols in recent years has been announced by the American Welding Society. The new standard contains many additions and improvements. Included are symbols for spot and seam welds made by arc welding; symbols for welds used in aircraft, guided missile, and automotive work; and symbols for the types of welds used in structural steel fabrication, reinforced concrete work, and the like. The Chart of Welding Symbols has been redesigned to incorporate the new developments. The charts come in two sizes—one for wall use, listed at $1.50, and one for desk use, listed at 50 cents. The standard sells for $3.00. All three may be ordered from Department T, American Welding Society, 33 West 39th Street, New York 18, N. Y.

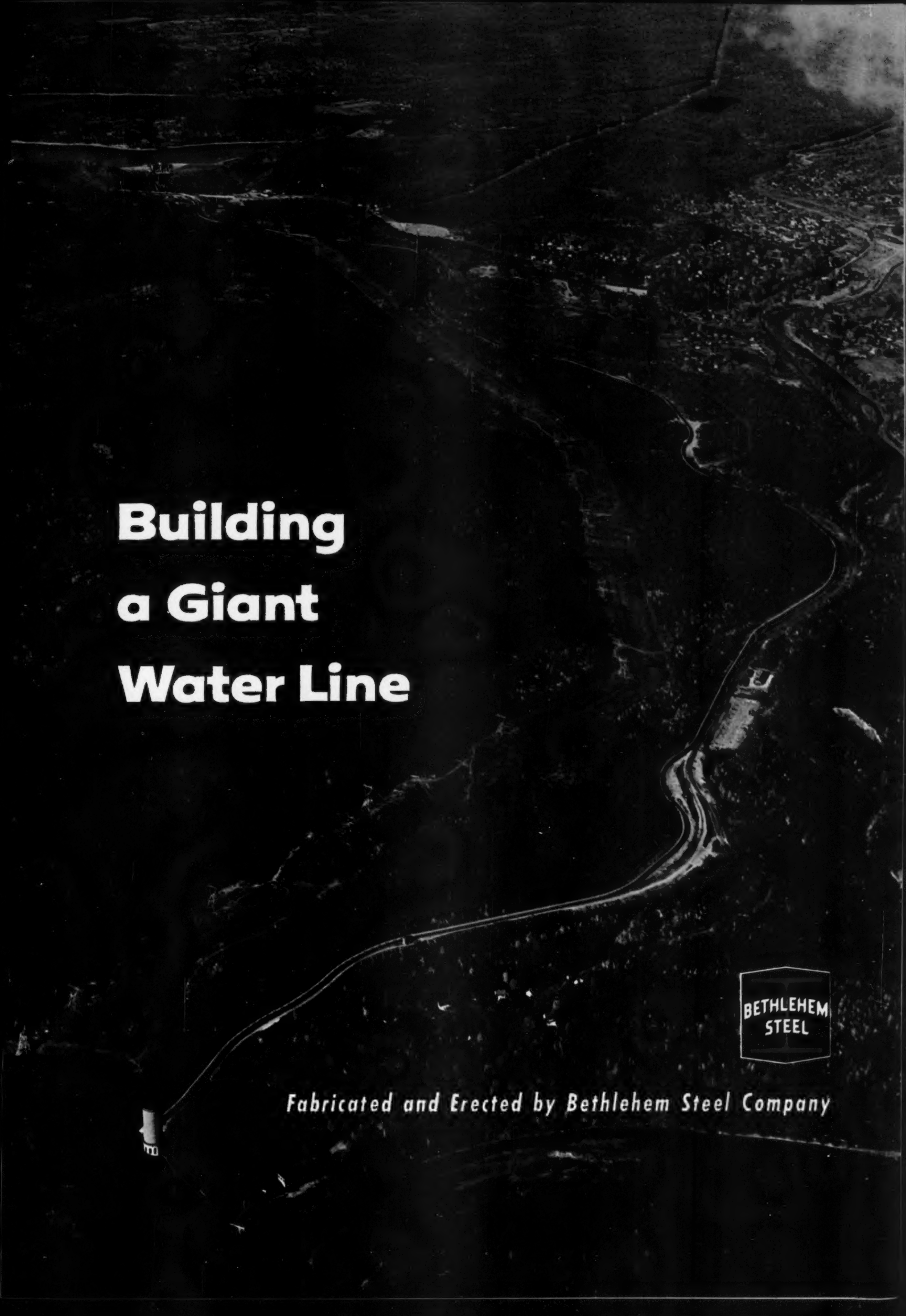
Hydraulic research . . . . Hydraulic research conducted in the past year in the United States and Canada is reported by the National Bureau of Standards in its Miscellaneous Publication 224. The 168-page compendium, the latest in an annual series going back to 1951, is intended as a guide in the coordination and planning of hydraulic research to help avoid duplication in the field. Copies, selling for $1.25 each, may be ordered from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

River hydraulics . . . . A discussion of the concepts of fluid mechanics, which are the foundation of river hydraulics, makes up U. S. Geological Survey Water Supply Paper 1369-A, entitled "Selected Topics of Fluid Mechanics." An important objective of the report is to familiarize the user with the literature of the science. The author is Carl E. Kindsvater, M. ASCE, regents professor of civil engineering at Georgia Institute of Technology and consultant to the Geological Survey. Inquiries about the report should be addressed to the U. S. Government Printing Office, Washington 25, D. C. (No price available.)

Highway engineering . . . . Two different phases of highway engineering are treated in two recent releases of the Highway Research Board. Bulletin

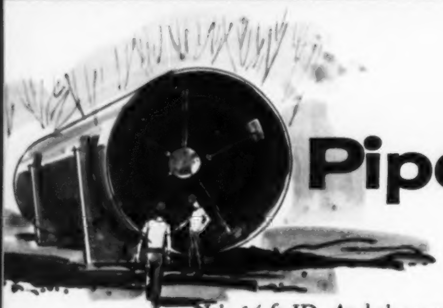
(Continued on page 119)

Building a Giant Water Line



BETHLEHEM STEEL

Fabricated and Erected by Bethlehem Steel Company



Pipe big enough to drive

It's 14 ft ID. And the spans you see here are 80 ft, center-to-center of the supporting ring girders. To the best of our knowledge it's the world's longest above-ground steel pipe line of such large size. And there's not an expansion joint in it!

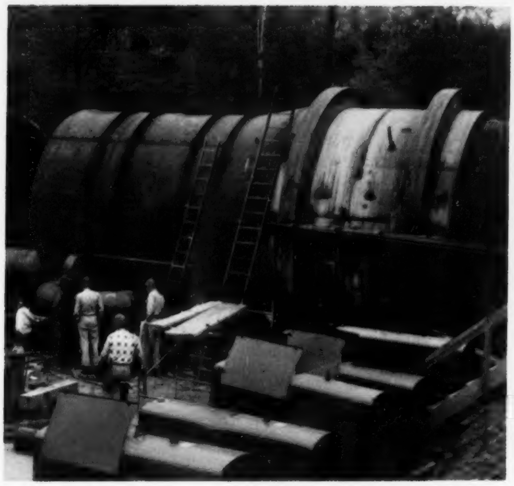
Completed in late Summer, 1958, the line is owned by Pennsylvania Power & Light Company. In the mid-1920's PP&L dammed the waters of Wallenpaupack Creek near Hawley, in northeastern Pennsylvania, and constructed a hydro-electric plant 3½ miles from the dam. To carry water from the dam to the surge tank, they built a 14-ft-8-in. OD (14-ft-ID) flow line. It was made of Douglas fir staves, reinforced with steel rods, and supported on riveted steel saddles 8 ft center-to-center.

Through the years the wood staves deteriorated to the point where maintenance was no longer economical or feasible. So PP&L, in consultation with Bethlehem engineers, decided to substitute welded steel pipe, replacing approximately one-half of the line in 1956, the remainder in 1958. Furthermore, to expedite the start of work on the first section, they utilized as much as possible of the old material. The concrete piers were re-used, as were the steel saddles (requiring that the outside diameter of the steel pipe be the same as the wood line—14 ft 8 in.).

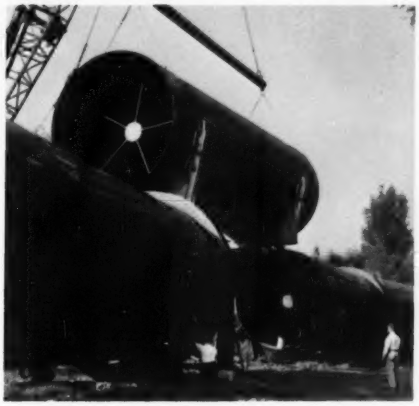
Experience gained in building the first section showed that it would be advantageous to re-design the line, rather than again re-use the old saddles and

In recent years, as shown here, the wood-stave line sprayed water from innumerable leaks. The steel saddles and tie rods, supplied by Bethlehem some thirty years ago, were still in relatively good shape.

In some locations there were overhead obstacles such as highway bridges and power lines. There the cans were pushed into place by a gasoline locomotive running on temporary tracks, or by a tractor.



In order to begin construction of the downstream half in 1956, the entire line was de-watered. Then a Bethlehem crew quickly installed this bulkhead section. Immediately the upper half of the line was re-filled, as the wood would have collapsed if allowed to dry out. In order to withstand the thrust of about 280 tons, the bulkhead was anchored by huge, gravel-filled cribs. The tie bars shown here (about 70 ft long, 1⅞-in. diam., made of alloy steel, heat-treated to a yield strength of 100,000 psi) were also supplied by Bethlehem.



Finishing the job. The last can, temporarily mounted on saddles, is lifted into place by an 80-ton-capacity crawler crane with an 80-ft boom. The can weighs 18 tons, and measures 38 ft - 6 in.

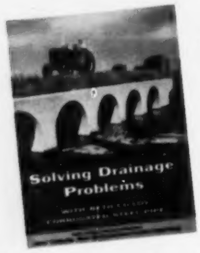
your car through

Welders at work. All welds were carefully inspected, and were also spot-radiographed.

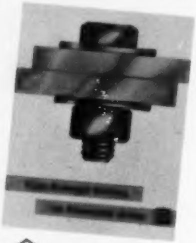
piers. Of primary interest in the new design are the long spans between ring girder supports. The entire 3½-mi line has no expansion joints; rotating and self-relieving anchors compensate for expansion and contraction.

In a fabricating yard set up along the line, the "cans" were assembled and welded. Each consists of five formed ½-in. plates shipped from our Steelton, Pa. fabricating works. The ring girders were fabricated in halves at Steelton, and assembled and welded in the field. The various members for the anchors were also fabricated before shipment to the job site for field assembly and erection.

A Complete Line of Steel for Construction



BOOKLET 425A. This informative manual is a "must" for anyone interested in drainage. With tables for evaluating flow friction.



BOOKLET 127C. Describes a wide variety of installations. Also available: Catalog 223, Bethlehem H-Piles; and Catalog 433, Bethlehem Steel Sheet Piling.

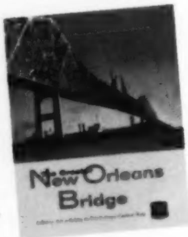
BOOKLET 495. Guide for high-strength bolting. Also available: literature describing standard and special fastener products.

CATALOG S-58. Describes standard structural shapes, with information and tables helpful to designers.

CATALOG 392. Summary of our full line of steel products for all phases of highway construction.

CATALOG 493. Recommendations for construction applications. One of many publications for users of wire rope, strand, and fittings.

HANDBOOK 393B. Complete information on continuous butt-weld and electric resistance-weld steel pipe.



BOOKLET 482. How the nation's longest cantilever bridge was built, in words and pictures. Also available: Booklet 454, Building the Walt Whitman Bridge.

PUBLICATIONS DEPARTMENT C-3
BETHLEHEM STEEL COMPANY,
BETHLEHEM, PA.

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Also send literature available describing these products:

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A partial, alphabetical listing of Bethlehem products for construction:

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Bridge rail
Cables for suspension bridges
Center strip and keyway
Centering, solid steel over joists
Culvert sheets, galvanized
Curb facing
Digging bars
Drill steel, hollow and solid
Dowels, hook-bolt
Dowel units
Fabricated steel bridges and buildings
Fasteners of all types
Fence and posts
Form stakes
Form wire
Guard rail; beam and cable
Hardware, timber bridge
High-strength bolts
Joists, open-web: series "S" and "L"
Nails
Paving steels
Piling; pipe, sheet, and H-piles
Pipe, large-diameter welded
Pipe piles
Pipe; butt- and electric resistance-weld
Plate
Posts, steel fence
Posts, steel guard rail
Reinforcing bar accessories
Reinforcing bars, plain and fabricated
Rock bolts
Roofing and siding, steel
Structural steel shapes
Tool steel
Tunnel-liner plates
Tunnel ribs
Tunnel segments
Wire rope and slings; strand
Yieldable arches for tunnel roof support

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by
Bethlehem Pacific Coast Steel Corporation
Export distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

Folder 680 593, Printed in U.S.A.

New Publications

(Continued from page 114)

190, containing five papers on "Urban Research in Highway Planning," sells for 80 cents; and Bulletin 191, consisting of eight papers on "Night Visibility," is $1.40. Orders should be sent to the Highway Research Board, 2101 Constitution Avenue, Washington 25, D. C.

Safety in construction . . . . Fourteen sectional pocket-size reprints from the Associated General Contractors' new "Manual of Accident Prevention in Construction" have been made available at 15 cents a single copy, $1.20 per dozen, and $9.00 per hundred copies. The sections, with their letter designation, are: Booklet A—Scaffolding and Ladders; Booklet B—Explosives and Powder-Actuated Tools; Booklet C—Housekeeping and Sanitation and First Aid; Booklet D—Welding and Cutting; Booklet E—Flammable Gases and Liquids, Handling and Storage of Materials; Booklet F—Excavation and Shoring, Barricades and Pipelines; Booklet G—Pile Driving and Marine Equipment; Booklet H—Concrete Construction, Masonry and Steel Erection; Booklet J—Hoists, Cranes, and Derricks; Booklet K—Highway Construction; Booklet L—Heavy Equipment; Booklet M—Tunnels and Compressed Air Work; Booklet O—Inspection Check List; and Booklet R—Introduction. The price of the complete manual is $3.75 a single copy, $41 per dozen, and $320 per hundred. Orders should be addressed to the Associated General Contractors, 20th and E Streets, N.W., Washington 6, D. C.

Storm drain design . . . . "Pressure Changes at Storm Drain Junctions" is the subject of Engineering Series Bulletin No. 41 of the University of Missouri Engineering Experiment Station, Columbia, Mo. The report describes model studies determining pressure changes at various rectangular and circular junction structures and includes working charts for use in the design of storm drain junction. The research—sponsored jointly by the Missouri State Highway Department and the U. S. Bureau of Public Roads—is described by W. M. Sangster, H. W. Wood, E. T. Smerdon, and H. G. Bossy. The complete report sells for $2.00, and the design methods section for $1.00.

Water pollution control . . . . Publication of a report, "Oxygen Relationships in Streams," is announced by the U. S. Public Health Service at Cincinnati. Issued as Technical Report W58-2 of the Robert A. Taft Sanitary Engineering Center, the 194-page volume presents the proceedings of a seminar sponsored by the Center's water supply and water pollution program in November 1957. Inquiries should be sent to the Robert A. Taft Sanitary Engineering Center, 4676 Columbia Parkway, Cincinnati 26, Ohio.

Technical translations . . . . This January the Department of Commerce began publication of a semi-monthly periodical that will serve as a central source of information in the United States on Russian and other technical translations available to science and industry. Subscriptions to the semi-monthly publication, entitled "Technical Translations," are available at $12 a year ($4.00 for foreign mailing). Single copies are 60 cents. Orders should be sent to the OTS, U. S. Department of Commerce, Washington 25, D. C.

Research and development . . . . Issuance of the Proceedings of the National Science Foundation's Conference on Research and Development and Its Impact on the Economy—held in Washington in May 1958—is announced by the Foundation. Copies are available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., at $1.25 each.

Hydrographic data . . . . Hydrologists, oceanographers, meteorologists, and other engineers who work with projects involving the measurement of flowing liquids or fluctuating liquid levels will find a wealth of technical data on float-operated level recorders in the sixth edition of the "Hydrographic Data Book," published by Leupold & Stevens Instruments, Inc. Part I contains information on float wells and instrument shelters; Part II discusses errors in float-operated devices; and Part III gives useful hydraulic tables and conversion charts. The volume was prepared and edited by ASCE Past President J. C. Stevens. The Data Book sells for $1.00 a copy. Orders should be sent to Leupold & Stevens Instruments, Inc., 4445 NE Glisan Street, Portland 13, Ore.

Positions Announced

(Continued from page 104)

neering and two years experience, of which one year should have been in the design of sewage systems, plus one year of advanced study which may be substituted for a year of experience. Applications may be sent to the Department of Civil Service and Personnel, Clayton G. Swanson, Director of Personnel, Room 403, Civil Center, San Diego, Calif.

U.S. Study Commission—Texas. Several openings for water resource development planning Engineers, Hydrologists, Writers are available with this new agency. Salaries $8,330 to $16,095. Federal, outside Civil Service Project to be completed in 30-36 months. U.S. Study Commission—Texas, 980 M & M Bldg., 1 Main St., Houston 2, Tex.

Federal Housing Administration. Opening for a Civil Engineer GS-12, salary starting at $8,810-$9,530. The position involves the review and analysis of residential-type storm drainage systems, soil mechanics problems and design and construction of street pavements for housing developments submitted to FHA for mortgage insurance in New York or Connecticut office. Submit application to Federal Housing Administration, Room 1077, Lafayette Building, Washington 25, D. C.

Applications for Admission to ASCE, Jan. 3-Jan. 31, 1959

Applying for Member

Benard Frank Barnes, Chattanooga, Tenn.
Robert Bersson, Madrid, Spain
Thomas Smith Carter, Jr., Dallas, Tex.
Paul Irvin Cripe, Indianapolis, Ind.
Lloyd Alfred Eckstrom, Ambridge, Pa.
Warren S. Everett, Carlisle Barracks, Pa.
Arthur Vincent Kage, New York, N. Y.
Harry Francis Lovell, Ft. Bragg, N. C.
Abraham William Martin, King of Prussia, Pa.
William Geddes Mitchell, Ontario, Canada
John Powell Mutchler, Kensington, Md.
Henry Patton McElrath, Jr., Shelbyville, Tenn.
Allen Hankins Nicol, Washington, D. C.
Rafael Otero-Munoz, Cartagena, Columbia
Robert Manley Ritchey, Jr., Santa Rosa, Calif.
Rowland S. Rose, Portland, Ore.
Roy Lamare Taunton, San Bernardino, Calif.
Jack Spradling Toler, Houston, Tex.
Vladimir A. Wahbe, Brooklyn, N. Y.

Applying for Associate Member

Ray Edward Aldrich, McCook, Nebr.
Mohammad Yasin Ansari, Aligarh, India
Walter A. Barbo, Seattle, Wash.
Louis Nelson Barfield, Jr., North Little Rock, Ark.
Barnett Samuel Bergman, Johannesburg, South Africa
Hugh Matheson Brown, New York, N. Y.
William Buse Dailey, Denver, Colo.
Woodrow Wilson Evett, Columbia, S. C.
Alan Michael Finn, Boston, Mass.
Roger Charlton Graham, Auburn, Ala.
Whitlow Ried Harris, Jr., Bristol, Va.
George Waugh Hutchinson, Sacramento, Calif.
Doyle Kennedy, New Smyrna Beach, Fla.
Sahoor Hasan Kirmani, Karachi, Pakistan
John Michael McKenna, London, England
Edward George Nawy, Cambridge, Mass.
James Henry Norris, Jr., Birmingham, Ala.
Harry Alexander Quinn, Jr., New York, N. Y.
John Richard Samuel, Richland, Wash.
John Gabriel Schuster, Baltimore, Md.
Heinz George Schwarz, Cleveland, Ohio
Webster Lee Smith, Jr., Baltimore, Md.
Francis Earl Swain, Denver, Colo.
David Abner Werblin, New York, N. Y.
Rubin Mershel Zallen, Boston, Mass.

Applying for Junior Member

Hugo Samuel Acevedo Ramirez, Mexico, D.F. Mexico
John Hiddleston Allen, Newcastle-on-Tyne. England
Antonio L. Aranguren, Blacksburg, Va.
Gerald Morris Brey, York, Pa.
John Riley Cumbus, Catawha, S. C.
Charles Walter Denzel, Vicksburg, Miss.
Allan Harry Haack, New York, N. Y.
David Joseph Hammond, Palo Alto, Calif.
David Erwin Kleiner, Wilmette, Ill.
William Norman Lofroos, Gainesville, Fla.
George Lorandos, Gary, Ind.
Collins Arnold Oladipo Abayomi Macauley, Birmingham, England
Folkert Klaas Menger, Portland, Ore.
Frank Paul Palumbo, Jr., Memphis, Tenn.
Gayle Beers Price, Jr., Dayton, Ohio
Milford Andrew Reisert, Miami Springs P.O., Fla.
Neil Roger Runyan, Columbia, Mo.
Richard Leroy Rusth, Manhattan Beach, Calif.
Walter Russell Umbach, Jr., Ithaca, N. Y.
Enrico Harry Wolf, San Francisco, Calif.
Adel Fareed Yacoub, Cairo, Egypt
Donald Walter Zierath, Ames, Iowa

[*Applications for Junior Members from ASCE Student Chapters are not listed.*]

New in Education

Summer Sessions . . . Six Summer Institutes on Nuclear Energy for engineering teachers will be held throughout the nation under the sponsorship of the

(Continued on page 125)

ENGINEERING SOCIETIES PERSONNEL SERVICE, INC.

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These items are listings of the Engineering Societies Personnel Service, Inc. This Service, which cooperates with the national societies of Civil, Electrical, Mechanical, Mining, Metallurgical and Petroleum Engineers, is available to all engineers, members or non-members, and is operated on a non-profit basis. If you are interested in any of these listings, and are not registered, you may apply by letter or resume and mail to the office nearest your place of residence, with the understanding that should you secure a position as a result of these listings you will pay the regular employment fee of 5 percent of the first year's salary if a non-member, or 4 percent if a member. Also, that you will agree to sign our placement fee agreement which will be mailed to you immediately, by our office, after receiving your application. In sending applications be sure to list the key and job number.

When making application for a position include 8 cents in stamps for forwarding application to the employer and for returning when possible.

A weekly bulletin of engineering positions open is available at a subscription rate of $3.50 per quarter or $12 per annum for members, $4.50 per quarter or $14 per annum for non-members, payable in advance.

Men Available

MATERIALS ENGINEER, A.M. ASCE. Twenty years' experience in concrete, asphalt, soils, construction control and design of airfields, roads, concrete and steel framed buildings, and masonry buildings. Has held positions as resident engineer, senior and chief materials engineer. Desires foreign employment in Europe, Latin America or North Africa. Speaks Spanish and French. C-425.

PROFESSOR, A.M. ASCE, Master's degree, 36. Sixteen years' structural and foundation design engineering experience, including six years' teaching. Presently, consulting engineer and teaching part-time. Desires teaching position. Location preferred, East Coast. C-426.

ENGINEER, M. ASCE, M.S. in C.E., 49. Licensed professional engineer. Experience includes seven years' civilian engineering and construction, twenty-one years' Corps of Engineers, Regular Army on engineering, construction, troop command, staff, management and administration. Present grade, Colonel; plans retirement. Available 90 days after notice for engineering planning, administration, professional writing, education. Location immaterial. C-427.

STRUCTURAL DESIGNER, M. ASCE, B.S., 36. Six years' experience on bridges and buildings. Location desired, New York, N. Y. C-428.

CIVIL ENGINEER, M. ASCE, B.S.C.E., M.G.A., registered P.E., Pennsylvania, Michigan, Massachusetts, 38. Nine years' municipal engineering; supervisory capacity, all phases of public works, i.e., design, plans, specifications, construction, inspection, of highways, sewers, water mains, etc. Three years' construction engineer, industrial plants. Desires position with consulting firm or in public works. Location desired, Boston area. C-429.

EXECUTIVE, A.M. ASCE. Construction, 38. Nineteen years' experience, residential, commercial, industrial, slipform, feedmill, all phases from preliminary design to completion, foreign and domestic. Internationally travelled; seeks challenging management position, home or abroad. Prefers warm climate. C-430.

FIELD ENGINEER, J.M. ASCE, P.E., Civil, 30. Two and one half years' of public works engineering experience; one and one half years as project engineer for consulting firm; two years with an industrial contractor. Will relocate. C-431.

STRUCTURAL DESIGN, J.M. ASCE, B.S.C.E., 27. Three years' experience in construction department of large firm. Has worked with steel, reinforced concrete and wood. Designed both simple and complex structures from roof to foundations. Location desired, Midwest. C-432-925-Chicago.

MANAGER OR ENGINEER, A.M. ASCE, B.S. in C.E., 52. Railway civil engineering: maintenance and construction of bridges, tracks, buildings, etc.; twenty-four years' in responsible charge. Location desired, U. S. or foreign. C-433.

STRUCTURAL ENGINEER, A.M. ASCE, B.S.C.E. and M.S., 34. Three years' heavy industrial de-

sign, two years' commercial design and three years' hydraulic structures. Location desired, South or Southwest. C-434.

CIVIL ENGINEER, ASCE Student Chapter member, 28. Will receive B.C.E. in June, 1959. One year drafting, steel detailing, design and quantity take-off; two years' construction surveying on highways and heavy construction, including supervision and inspection; three and one half years' traffic engineering in responsible position as engineer-in-charge of municipal parking meter program. Desires position as civil engineer on highway or heavy construction project. Available immediately after graduation. Location desired, Africa. C-435.

PROFESSOR OF CIVIL ENGINEERING, A.M. ASCE, M.S. in civil engineering. Four and one half years' teaching experience and fourteen years' experience in surveying and mapping. Desires position teaching surveying, geodesy and related subjects. Has had management experience. Registered Land Surveyor. Location desired, West. C-690-San Francisco.

PROJECT ENGINEER, A.M. ASCE, B.C.E., 37. Over ten years in responsible positions on hydro-electric and water control projects, including design, construction, reports and estimating. Location desired, Foreign. C-631-San Francisco.

STRUCTURAL DESIGN ENGINEER, J.M. ASCE, B.S.-Ae.E., B.S.C.E., 29. Four years' diversified experience in the structural design field. Familiar with design of reinforced concrete, steel and timber structures. Structures include bridges, buildings, foundations, power plants, sewage treatment plants, etc. Last two jobs in missile field and aircraft industry in the capacity of senior design engineer. Location desired: South, Midwest or Foreign. C-436-926-Chicago.

Positions Available

STRUCTURAL ENGINEER, graduate civil, with some experience, to do design and detailing on industrial buildings, bridge and grade separation work and general highway facilities. Will also include quantity and cost estimates and other related work. Some travel. Salary open. Location, Louisiana. W-6798.

CIVIL ENGINEER, graduate, with outstanding record and experience in building construction, for excellent, diversified position with general contractor. Location, New York, N. Y. W-6866.

CONSTRUCTION SALES MANAGER, graduate engineer, preferably from M.I.T. or similar school, with outstanding sales and management ability. Excellent opportunity with well established building contractor. Location, New York, N. Y. W-6875.

CIVIL ENGINEER, graduate, with three to five years' experience in municipal utilities. Work will be in the design of structures, water supply and distribution systems, water treatment, sewers, pumping stations and sewage treatment facilities. Salary open. Location, West. W-6926.

TEACHING PERSONNEL. (a) Department head for civil engineering department, Ph.D., with university and administrative experience and ability to initiate and develop research and graduate work. Salary, $8,500-$14,500. (b) Lecturer or professor to teach and do research in soil mechanics and transportation engineering. Salary dependent on qualifications. Medical, hospital and pension plans in effect. Rapidly developing graduate study and research programs. Location, Canada. F-6944.

CONSTRUCTION MANAGERS with extensive and overall responsibility for industrial construction, especially in fertilizer (urea) and paper and pulp. Locations, Foreign. F-6964.

CONSTRUCTION SUPERVISOR AND ENGINEER to supervise large chain store construction throughout the country; check plans, specifications, lighting, power, etc. of all work done by contractors. Salary, $10,000-$12,000 a year. Some travel. Headquarters, New York, N. Y. W-6988.

TEACHING PERSONNEL for Department of Civil Engineering, to teach the normal civil engineering courses such as strength, dynamics, surveying and related courses. Salary, eight and one half month college year, contingent upon education and experience. Available for the 1959-1960 college year. Location, Pennsylvania. W-7005.

STRUCTURAL ENGINEER, civil graduate, with about ten years' design experience covering industrial buildings and considerable power plants. Salary, $10,000-$12,000 a year. Location, New York, N. Y. W-7025.

CIVIL ENGINEER for work in highway and bridge construction and maintenance on county level. Salary, about $5,200 a year. Location, upstate New York. W-7026.

ASSISTANT in sponsored research, graduate civil, mechanical or electrical, for a college. Opportunity to do graduate work tuition free. Summer months, full time, during academic year half time. Starts September 1959. Location, New Jersey. W-7044.

PROJECT ENGINEER for the design, writing of specifications, contracts, layout for construction and general supervision of construction for sanitary sewers, sewage treatment, drainage, water supply, grading, and general site planning for schools, commercial and residential developments. Apply by letter giving complete information including salary requirements. Salary, plus fringe benefits. Location, upstate New York. W-7051.

SALES ENGINEERS for permanent positions in fast-growing phase of heavy construction. Familiar with excavation methods and equipment. Civil engineering background desirable but not necessary. Must be willing to travel in southeastern U.S. Excellent future. Headquarters, New York Metropolitan area. W-7052.

CIVIL ENGINEERS. (a) Sanitary and Civil Engineers with several years' experience in the field of water and sewage works and industrial wastes. Excellent opportunity with growing firm. Salary commensurate with ability; fringe benefits. (b) Resident engineer, thoroughly experienced, for inspection and supervision of construction of large sewage treatment plant and intercepting sewers.

(Continued on page 125)

ESPS

(*Continued from page 123*)

Salary open. Location, New York State. W-7062.

ESTIMATOR, building construction, preferably civil graduate, with a minimum of ten years' experience taking off and figuring from plans or proposals for commercial and industrial steel buildings. Salary, $7,800-$9,000 a year. Location, San Francisco East Bay. S-4077.

PROJECT ENGINEER, railroad and terminal, civil graduate, with ten or more years' project engineering experience on grading, surfacing, bridging, piling, for railroad, docking, terminal and some camp facilities. Salary, $12,000 a year. Location, British Guiana. S-4079.

CIVIL ENGINEERS. (*a*) Designer, structural, civil graduate or equivalent, with a minimum of five years' experience working up design, layouts and drawings for bridge type dynamic structures (cranes, heavy material handling equipment, batching plants); able to compute, determine and work with vibration and stress principles; for manufacturers of steel fabrication. Salary substantial. (*b*) Draftsman, structural, structural background, well qualified to assist structural engineer in preparation of layouts and shop drawings for bridges, cranes, batch plants, gear and roller assemblies type structures for manufacturer steel fabrication shop. Salary, $6,600-$7,800 a year. Location, Oregon. S-4084.

JUNIOR CIVIL ENGINEER, public works, graduate civil from an accredited college. Field and office, includes drafting, design of simple structures, construction inspection, cost estimating, research in methods and materials, right-of-way engineering and other duties of similar nature. Salary, $5,628-$6,840 a year. Location, San Francisco East Bay. S-4087.

STRUCTURAL DESIGNER, bridges, B.S.C.E., plus experience in drafting and designing steel, concrete and timber structures. Bridge experience very desirable. Permanent with large operating company. Salary open. Location, San Francisco, S-4105.

SALES ENGINEER, concrete treating chemical, graduate civil, with a minimum of five years' sales and merchandising experience, familiar with general construction industry, preferably in cement and concrete technology. Will provide engineering technical and application information to contractors and engineers for chemical additive to cement, concrete and asphalt for international organization regional sales office. Thirty per cent travel throughout 11 western states. Car furnished for local work. Salary, $9,000-$12,000 a year. S-4112.

DESIGNER, sewerage treatment, collection, civil graduate, preferably with sanitary option, with a minimum of two to three years' experience in design of sewage treatment and collection treatment desired but will consider other related work. Will work for consulting engineering office preparing plans and specifications. Growth opportunity for young engineer. Salary, $6,600-$7,200 a year. Location, Modesto, Calif. S-4113.

SUPERVISING ENGINEER, structural, B.S.C.E. and experience in structural engineering, to qualify as head of Building and Structures Branch Engineering Section; will plan, direct and administer all matters relating to new buildings and maintenance of existing structures. Salary, $10,130 a year. Must be U. S. citizen. Location, San Francisco. SG-4122(a).

GENERAL ENGINEER, civil graduate, as project engineer for Post Engineering Section; coordinate plans and projects division with other Branch Chief. Requires experience as specification writer. Must be U. S. citizen. Salary, $7,510 a year. Location, San Francisco. SG-4122(b).

JUNIOR CIVIL ENGINEER, utility, preferably B.S. (minor in economics or business administration would be helpful); with from none to three years' experience and interested in administrative work, to assist engineers on economic and engineering studies of public utility operations. Some travel to the branch offices in California will be required. Salary, $5,760 a year to start. Employer will discuss payment of placement fee. Headquarters, San Francisco. S-4124.

New in Education

(*Continued from page 120*)

Atomic Energy Commission and the American Society for Engineering Education. Attendees will be selected by subcommittees of the ASEE Nuclear Committee on the basis of experience and the use to be made of the training. Dates for the two basic and three advanced courses are June 22 to Aug. 14. The one course for teachers in technical institutes is from June 29 to Aug. 7. Applications, obtained from directors of engineering or technical institutes, or from ASEE headquarters, should be sent *at once* to Prof. W. Leighton Collins, Secretary of the ASEE, University of Illinois, Urbana, Ill. . . . The *University of Michigan* announces its 1959 summer program of intensive non-credit courses for practicing engineers and scientists. For a list of the nineteen courses and further information write R. E. Carroll, University of Michigan College of Engineering, Engineering Summer Conferences, 2038 East Engineering Building, Ann Arbor, Mich. . . . The Civil Engineering Department of *Manhattan College* offers a one-week course on the Theory and Design of Biological Waste Treatment, beginning June 15. All correspondence should be addressed to W. Wesley Eckenfelder, Jr., Civil Engineering Department, Manhattan College, New York 71, N. Y.

Cleveland Convention of ASCE
Sheraton-Cleveland Hotel, Cleveland, Ohio May 4-8, 1959

(*Please print*)

Name ....

Street ....

City ....Zone......State..................

Mail to:

ASCE Convention Reservations
Sheraton-Cleveland Hotel,
Public Square & Superior Ave., Cleveland 1, Ohio

Please reserve for my occupancy the following hotel accommodations:

Double ....Single ....

Double-twin beds ....Suite ....

Other ....

Date and hour of arrival ....

Date of departure ....

Advance Information on Attendance at ASCE Cleveland Spring Convention

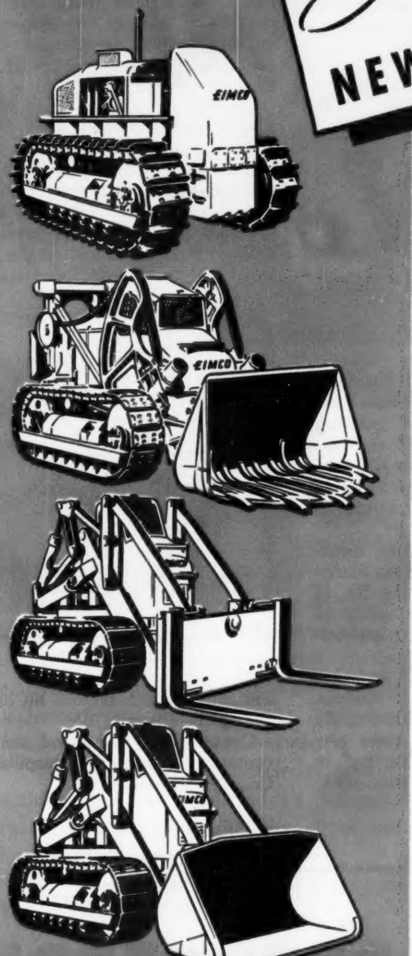
This is not an advance order. Do not send payment. No name needed.

To: MR. WENDELL R. SWATOSH,
General Chairman,
Cleveland Convention Committee, ASCE,
700 Midland Building,
Cleveland 15, Ohio.

It is my plan to attend the Cleveland Convention. I shall have ...... guests attending with me. During convention I plan to attend the following events, tickets for which I shall purchase when I arrive:

FUNCTION	NO. OF TICKETS
Mon., May 4	
Luncheon	.....
Ice-breaker & Buffet Dinner	.....
Tues., May 5	
Luncheon	.....
Wed., May 6	
Luncheon	.....
Dinner and Reception	.....
Thurs., May 7	
Luncheon	.....
Dinner at Cleveland Eng. and Scientific Center	.....
Fri., May 8	
Inspection Trip to National Aeronautics and Space Admin. Research Center (only U.S. citizens permitted to visit.)	.....

THE BIG E *Announces* NEW MODEL DESIGNATION FOR SPECIALIZED CRAWLER EQUIPMENT



EIMCO 105

This is the basic **Tractor** available with **Dozer, Excavator** or **Excavator-Dozer** Attachments.

EIMCO 115

New number designation for Eimco's rugged **Steel Mill Excavator.** Extra-Strong, for use in slag pits and other steel mill areas.

EIMCO 125

This is model number for the **Front End Loader and Fork Lift . . .** fast, maneuverable, strong.

EIMCO 135

Specify this number for **Eimco's Steel Mill Front End Loader . . .** specially engineered and proven in use in steel mills throughout the world!

Every Eimco Crawler Unit gives you greater maneuverability, greater production and work-output, greater economy . . . engineered for service to your industry to save you time and maintenance costs.

Write for facts and qualified engineering assistance on Eimco . . . the MODERN Equipment.

THE EIMCO CORPORATION • SALT LAKE CITY, UTAH

EXPORT OFFICE, 51-52 SOUTH STREET, NEW YORK, N. Y.

BRANCHES AND DEALERS IN PRINCIPAL CITIES THROUGHOUT THE WORLD

B-388

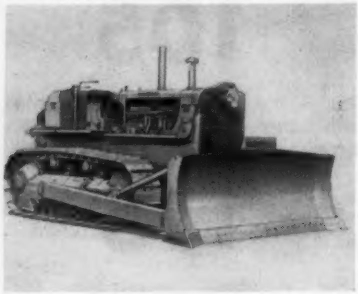
EQUIPMENT, MATERIALS and METHODS

NEW DEVELOPMENTS OF INTEREST AS REPORTED BY MANUFACTURERS

NEW EQUIPMENT BY CATERPILLAR

• Two COMPLETELY NEW D8 TRACTORS, both possessing increased weight, horsepower, and productive ability over their predecessors, have been announced. The machines are the Series H D8 direct drive and torque converter Tractors.

The weight of the direct drive D8 is 47,102 lb, an increase of 4,377 over the previous D8; and in torque converter models, the 47,875-lb weight of the new series is 4,480 lb greater than the old machine. Flywheel horsepower of the units has been increased to 225 from the



Series H D8

previous 191, and drawbar horsepower on the direct drive model is upped to 180, this increased horsepower coming primarily from the addition of a turbocharger.

The engine has newly-designed manifolding to accommodate mounting of the turbocharger and air cleaner. To increase engine efficiency, the inlet and exhaust passages within the head have been streamlined, permitting a maximum amount of air to enter each cylinder and reducing back pressure by the fast discharge of burned gases.

• RATED AT 150 HP WITH AN 18% torque rise and weighing more than 29,000 lb, the No. 14 Motor Grader has joined the Caterpillar line as the largest, most powerful motor grader ever to be manufactured by the company.

18% Torque Rise

The use of 10.00-in. rims for the 14.00 x 24 tires provides a wide rim base thus straightening side walls and reducing any side-rolling tendencies. Of the machine's total weight, 22,000 lb rest on the drive wheels where it can be used, giving the unit the traction to fully utilize its large size and power.

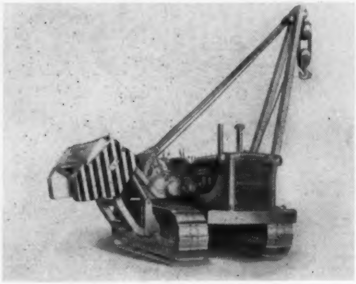
The 12-ft blade with its 27-in. moldboard and 5-in. clearance between bladetop and circle drawbar, gives the No. 14 the ability to carry large amounts of material on the blade without interference with its flow.

A new positive mechanical lock has been incorporated in the power controls. When the hand control is in neutral, the powershaft is locked firmly in place, preventing any variation or "creeping" in the machine function being controlled; a high-speed, two-tooth control clutch eases engagements and cuts "kickback".

• INCREASED LIFTING CAPACITY AND GREATER horsepower, due to the incorporation of a turbocharger, an exhaust-driven turbine which packs more usable air into the cylinder to increase combustion efficiency, are two major benefits that pipeliners can expect from the Series H No. 583 Pipelayer.

Steering clutches are hydraulically actuated, which not only reduces operator effort, but also eliminates the need for adjustments since wear does not influence the operation of the actuating mechanism.

An undercarriage feature of great importance to the machine owner, which has also been introduced on the D8 Tractors, is the Lifetime Lubricated rollers



Increased Lifting Capacity

and idlers, which require no lubrication during their service life.

Controls are positioned for greatest operator convenience. **Caterpillar Tractor Co., CE-3, Peoria 8, Ill.**

Manual Road Profilometer

THE MANUAL ROAD PROFILOMETER is designed to complement the truck type. Its use is limited to jobs where hand pushing is necessary or satisfactory, such as on fresh pavement or special study areas. It is ideal for contractors for checks of pavement while it still is fresh.

It works on the same principle as the truck type, but does not include many of its features. The bogies are made from bicycle wheels and are designed to "integrate" the road and support the unit at the same time.

The unit is completely mechanical and thus no power supply is required. There is only one recorder wheel so only one wheel path at a time can be traversed. There are no printouts or roll indications. The machine can be provided with an integrating counter and pipping pens for indicating cracks and joints. **Micrometrical Development Corporation, CE-3, 2821 South State Street, Ann Arbor, Mich.**

Truck-Cranes

THREE NEW TRUCK CRANES, capable of handling up to 200 ft of boom and jib, have been announced. The 40-ton HC-108A will lift and handle, unassisted, 200 ft of the optional "Hi-Lite" tubular boom and jib, while the 35-ton HC-98A and 30-ton HC-88A handle 180 ft and 160 ft respectively.

The Zephyrcranes offer many specialized lifting crane features designed to tailor the machines to any job requirements. Among these are Speed-o-Matic power hydraulic controls, reversing clutches for either or both main drums, independent rapid boomhoist with boom lowering clutch, pin connected crane boom, swing brake, retractable high gantry and hydraulic counterweight removal jacks. **Link-Belt Speeder Corp., CE-3, Prudential Plaza, Chicago 1, Ill.**

Heavy End Aluminum Pipe

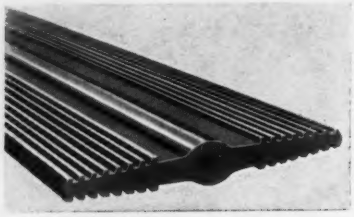
WHILE OFFERING INCREASED STRENGTH and thickness at pipe ends where welded or threaded joints are made, this heavy end aluminum pipe utilizes less metal in the pipe body.

By putting metal where it is needed for strength in the joints, and eliminating excess thickness in the pipe body, the users are given operating pressures equivalent to standard pipe with cost savings ranging by pipe size up to 27%.

Presently offered in selected sizes equivalent to many standard Schedule 40 and 80 sizes, the pipe is lighter than the conventional aluminum product, thus reducing shipping and handling costs. **Reynolds Metals Co., CE-3, Reynolds Metals Bldg., Richmond 18, Virginia.**

Improved Waterstop

EXTRUDED FROM A SPECIAL COMPOUND of Polyvinylchloride to which has been added important plasticizers and stabilizers to provide all of the qualifications



Tenacious Holding Power

necessary for the effective performance of a waterstop, "Hydrojoint" PVC Waterstops are engineered with unique cross-section featuring improved-design multi-ribs to provide a tenacious holding power.

Strong, lightweight and easy to handle, the waterstops are supplied in 50-ft coils—individually packaged. Able to be bent around corners or formed in curves to meet job requirements, they may be quickly and easily spliced on the job by merely applying heat until melting occurs and then pressing the ends together until the splice cools. **W. R. Meadows, Inc., CE-3, 26 Kimball St., Elgin, Ill.**

Sleeve For H Beam Pile Connections

SIMPLE IN CONSTRUCTION, THE SLEEVE consists of two channel shaped plates, rigidly separated by a welded connection providing a space equal to the web of the H beam pile to be driven. The flaps of the channels forming the sleeve are flared outward to make a tight fit between the flange of the pile, making the sleeve a driving fit. It is sledged into position while the second section of the pile being driven is lying on the ground.

Two or three inches of the flap of each channel is welded to the inside of the flanges of the H beam and the flanges of this pile are chamfered with a torch to take the weld when in final position. This second pile section is picked up by the crane, positioned over the pile section already driven in the ground. The flanges of the pile are then welded, two or three inches of the flaps on the channels are welded to the inside of the flange of the H beam pile and driving is resumed.

The sleeve was patented by Francis L. Pruyn, Chairman of the Board of Underpinning & Foundation Co., Inc., New

(Continued on page 134)

RIGHT...from the top down

A good, dependable water supply system is no better than its beginning. The best beginning is a Layne drilled water well. Layne is the largest water well drilling organization in the world with over 75 years experience. Trained crews operate over 500 drilling and service rigs throughout the country.

Layne service doesn't stop there. A dependable Layne Pump specially designed for the job to deliver a specified QUANTITY of water, and Layne water treatment service to supply the exact QUALITY of water desired, are part of a complete job with undivided responsibility. But, that's not all. Layne maintenance and repair service wraps up the complete package. Your nearby Layne Company is as close as your telephone, so, call on Layne for a dependable water supply, right . . . from the top down, all backed by Layne Research.

LAYNE & BOWLER, INC., MEMPHIS
Offices and Factory, Memphis 8, Tenn.
WATER WELLS • VERTICAL TURBINE PUMPS • WATER TREATMENT

Layne

WELL DRILLING
and other allied Drilling Services

ASK THE MAN FROM YOUR NEARBY LAYNE ASSOCIATE COMPANY—[illegible] Layne-Central Company, Memphis, Tennessee • International Water Corporation, Pittsburgh, Pennsylvania • [illegible]

Ohio's 1,524-mile Interstate Program

120 tons of steel reinforcement per mile will make Ohio's Interstate highways stronger and longer lasting. USS *American* Welded Wire Fabric, made of cold-drawn steel wire, withstands high unit stresses; permits construction of concrete slabs 30% stronger and up to 100 feet long. *American* Transverse Road Joint Load Transfer Assemblies also help assure a permanently smooth-riding road surface.

800 bridges, underpasses and overpasses will stud the Interstate network in Ohio. Much of the 398,670 tons of steel used in these structures—beams and girders, plates, piling, bridge railings, etc.—will be furnished by United States Steel. USS *Tri-Ten* Steel and our other High Strength Steels, USS *Cor-Ten* and USS *Man-Ten*, as well as USS "*T-1*" Constructional Alloy Steel, are available for bridges in which weight saving is essential. USS AmBridge *I-Beam-Lok* Flooring, open or concrete filled, will keep weight and maintenance to a minimum. USS *American Super-Tens* Stress-Relieved Strand and Wire are also available.

A sturdy backbone of steel goes into the deck and piers of every Interstate bridge built in Ohio. Specifically designed to produce a better reinforced concrete at lower cost, USS *Di-Lok* Bars feature a continuous diamond-shaped interlocking deformation that assures positive anchorage in the concrete and reduces cracking to the minimum. Used with *Atlas Duraplastic*, an air-entraining Portland cement that fortifies concrete against freezing-thawing weather and scaling caused by de-icing salts, this superior reinforcement ensures the maximum of strength and permanence.

York City, and manufactured by Commercial Shearing & Stamping Co., Youngstown, Ohio. **Associated Pipe & Fitting Co., CE-3, P. O. Box 67, Cedar Grove, New Jersey.**

Vibro-Tamper Attachment

THE NEW VIBRO-TAMPER ATTACHMENT Model J-4 can be towed to or from the job site and can be quickly mounted on any standard make front-end loader or wheel tractor with front-end loader attachment. It can also be towed behind the loader or wheel tractor while compacting.

Self-Contained

Model J-4 is self-contained and does not require any type of auxilary power installation on the propelling tractor for its operation. The tractor is used only for moving the J-4 either forward or backward over the material being compacted. Each shoe or pad utilizes the same powerful 10,000-lb blow as that of the larger self-propelled Vibro-Tamper. **The International Vibration Co., CE-3, 16702 Waterloo Rd., Cleveland 10, Ohio.**

Portable Diamond Core Drill

A PORTABLE ELECTRIC Diamond Core Drill and accessory thin wall Diamond Bits for drilling close-tolerance holes and test cores up to 9 in. in dia through reinforced concrete, masonry, tile, brick, asphalt and rock, has been developed.

This compact drilling unit can drill vertical, horizontal or angle holes and is used for the installation of pipe, electrical conduit, anchor bolts, air conditioning and ventilating systems as well as taking test cores.

High penetration rate, low cost per hole, noiseless-dustless operation and the ability to drill any material are some of the many advantages offered by the drill. **Geo-Drill Co., CE-3, P. O. Box 6, Bridgeville, Pa.**

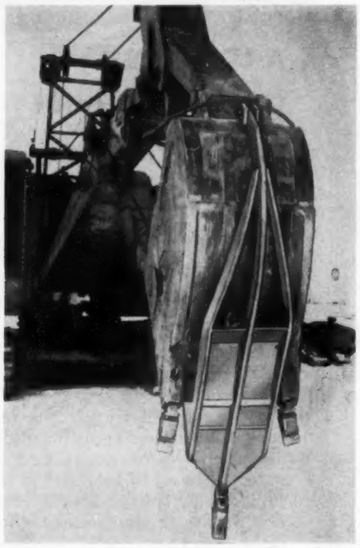
Adjustable Form Brace

AN ADJUSTABLE STEEL FORM brace that can be used indefinitely and a brace extension are now being marketed to go with the company's line of prefabricated concrete forms and forming hardware.

The brace is designed so that it can be easily adjusted either by a man atop the forms or by the crew on the ground. It is adaptable to either light or heavy construction in that it comes in regular lengths of 6 ft and 10 ft 6 in. or on special order in 15 ft or 19 ft 6 in. for single or multiple pours. The brace becomes an even more versatile, economical tool when used with the brace extension, which is being sold in standard lengths of 4 ft 6 in. and 9 ft or on special order in any size desired by the customer. **Symons Clamp & Mfg. Co., CE-3, 4249 West Diversey Ave., Chicago 39, Ill.**

Hoe Bucket Attachment

Custom made to fit all makes of buckets, the Rapid Ripper rips hard and frozen ground while digging at half throttle with no danger of breaking or damaging hoe boom or bucket. This attachment makes possible one machine operation on hard or frozen ground where additional digging machinery would normally be required. Able to rip through 30 inches of solidly frozen



Fits All Buckets

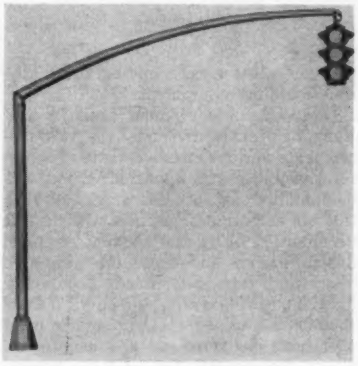
ground in 30 min, the Ripper contains a device which protects bucket teeth and lip while breaking ground.

Initial installation requires welding two pin supporting ears to back of the bucket—a 15-min operation. After welding ears, the Ripper takes less than two minutes to attach, and only one minute to remove. It does not interfere with normal digging operations after tough ground has been pierced. **Rapid Ripper Mfg. Co., CE-3, 4-½ Mile Road, Racine, Wis.**

Traffic Signal and Lighting Standard

The new cantilever design, named the Classic and made for traffic signal and lighting standards, is in keeping with the trend to functional streamlined styling, and eliminates much banjo work, making installation and maintenance a much simpler job.

The traffic signal standard has been designed to eliminate vibration or flutter, and has been tested for winds of hurri-



The Classic

cane velocity. Available in steel or aluminum, it can be rotated to any particular point within a 360-deg circle. It is available with arms 10, 12, 15, 18, 20 and 25 ft in aluminum and up to 35 ft in steel; and its matching lighting standard with arms 4, 6, 8, and 10 ft in both steel and aluminum. **Kerrigan Iron Works, Inc., CE-3, Box 479, Nashville, Tenn.**

Wagon Crane

Designed primarily as a rehandling machine and for drop ball application in quarries, the Type 362 Wagon Crane can carry up to 120 ft of boom and 15 or 20 ft jibs for added versatility in crane work.

Mounted on a 20-ft 1-in. Maxi carrier, the crane has a working weight of 111,700 lb; the width is 12 ft 2 in. and the overall height is 18 ft 9 in.

Power is furnished by either a GM 6-71 diesel with electric starter and straight drive standard, or a Cat D326F with gasoline engine starter with speed reducer drive standard. **Marion Power Shovel Co., CE-3, West Center, Marion, Ohio.**

Plant Fabricates Cabs

The company's Miller Street plant, where main frame welding and final assembly of straddle carriers were performed before the Ross Division was moved to Battle Creek, will fabricate all-

(Continued on page 136)

EQUIPMENT MATERIALS and METHODS

(continued)

weather cabs for earthmoving and materials handling equipment.

Designed for equipment built by the company's other divisions, the cabs incorporate various improvements in structure, visibility and appearance, and will be mounted on fork lift trucks, towing tractors and straddle carriers. Others will be mounted on tractor shovels, scrapers, dozers, loggers and excavator cranes. A quantity of cabs have already been made for giant Michigan 375-hp 6-cu yd tractor shovels and cabs for other models have also been delivered or are in process. **Clark Equipment Co., CE-3, Benton Harbor, Mich.**

New Trencher

Quickly detachable to free the tractor for power tilling, grading, plowing or any of the many other jobs usually accomplished with a single tractor, the "Laster" Trencher does not interfere with front-mounted equipment.

Any wheel type tractor, with a live power take-off, ASAE Standard 3-point hitch, can be equipped to operate the trencher. An "Incher" device moves the

Boom Extension Available

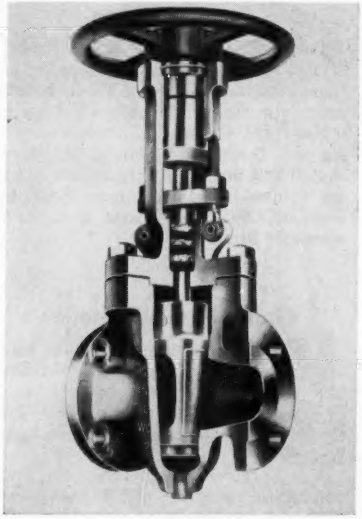
tractor forward at the correct rate of speed to allow the adjustable high carbon, abrasion resistant steel cutters to dig from 6-in. to 14-in. wide trenches.

Moving along at speeds up to 500 ft per hour under the ample power of the tractor, the machine digs a clean trench to a maximum of 4 ft in depth with standard equipment. Boom extension is available for deeper trenching. **Deltec, Inc., Laster Trencher Div., CE-3, 185 Industrial Rd., Youngstown 9, Ohio.**

New Valve

THE AVAILABILITY OF A NEW non-lubricated general purpose valve with two Teflon (DuPont trademark) "O" rings in the face of the plug, has been announced. Called the Wedgeplug "O-Seal," it will effectively double-block and bleed in most services to do the job of two ordinary valves or a line blind.

The "O-Seal" is non-lubricated and requires no maintenance; the pressure sealing effect of the "O" rings provides absolute shut-off that remains perma-



No Product Contamination

nently "bubble-tight."

Operation of the "O-Seal" is quick and easy. Other advantages of the new valve include protected seats, double seating for double safety, and the assurance of no product contamination.

Because of the double pressure-sealing effect, the upstream as well as the downstream seats hold "bubble-tight" against line pressure. The bottom drain plug can be pulled to provide the tell-tale bleed. **Wedgeplug Valve Co. Div. of Stockham Valves & Fittings, CE-3, 4006 N. 10th Ave., Birmingham 2, Ala.**

Pole Derrick

A NEW HYDRAULIC DERRICK is now available with side movement, allowing it to reach 9 ft to either side from the center line of the truck chassis. Model DHDS provides sheave heights of 25, 27, 29 ft and a simple extension of the derrick side legs allows an additional 2 ft in each of these sheave heights.

Designed to go to the ground and apply 3000 to 4500 lb down pressure on the derrick supported digger, it has a lifting capacity from 2500 lb with sheave at ground level to 12,500 lb at maximum elevations, and will body load 8500 lb and handle side reach position loads up to 3500 lb.

The mounting platform is elevated by simple boost rams. The control valve operating these boost cylinders automatically controls the main cylinder. Each side leg cylinder is operated by a separate valve and these cylinders are an integral part of each leg. **Utility Body Co., CE-3, 1530 Wood St., Oakland 7, California.**

Tractor Attachments

FAR FROM BEING SIMPLY ATTACHMENTS hung onto the basic 105 Tractor unit, many of the machines are specially engineered for specific jobs on which they will be used.

Those machines newly designated with separate model numbers are those requiring special engineering and manufacturing techniques to take the stresses

Model 125

of year in and year out heavy specialty use and assure economical, efficient long life and production to the user. Some of these are: the Model 115 Steel Mill Excavator, Model 135 Steel Mill Front End Loader, and Model 125 Front End Loader & Fork Lift. All have the exclusive torque converter—"Unidrive" transmission team, and are built to the highest standards in the industry, assuring longer low-cost operational life, according to the manufacturer. **The Eimco Corp., CE-3, P. O. Box 300, Salt Lake City 4, Utah.**

New Rock Picker

PROVED HIGHLY SUCCESSFUL IN THE majority of projects having rock problem, the Model 876 Bestland Sky Boy Rock Picker is hydraulically controlled throughout and the operator never leaves the tractor seat. Model 876 has an 8-ft picking swath to insure picking great quantities of rocks and yet have excellent maneuverability.

The picking tines have adjustable spacing from 1-¾ in. apart to any spacing desired. The unit will thus pick the small rocks and will also pick rocks up to 1000 lb in weight depending on the shape. The hopper box has approximate 4000-lb capacity and is lifted by 8300-lb push power telescopic cylinders.

Hydraulically Controlled Throughout

The tine point penetration under the rocks is set by means of adjustable stops so that the tine points just get under the rocks and the operator may set the stops for the particular operation. The penetration point of tines is directly in line with the contact point of the front swivel wheels insuring true contour picking. **Viel Manufacturing Co., CE-3, Box 632, Billings, Montana.**

Avol Rule

THE AVOL RULE IS DEVELOPED to measure an area of any plane figure drawn to a given scale. Equally spaced parallel lines are measured within a given area, the total length of which is the area. Parallel lines within an area are supplied when the figure is plotted on cross section paper, otherwise they are supplied by a half inch parallel line over-lay made of transparent material.

The rule will read square feet directly if parallel lines are measured one half inch apart, and the center scale gives the corresponding volume if that area extends fifty feet. It is readily seen that if the areas are regular templated cross sections drawn for earth work quantity estimates, the desirable thing is the volume; there being no need to record area any place, but the volume only is read on the middle scale and recorded.

By applying the Avol Rule to the single end area and distance method of computing preliminary quantities of excavation and embankment, the computation is made faster and more accurately. **Johnson Instrument Co., CE-3, 126 N.E. 28th Ave., Portland 12, Oregon.**

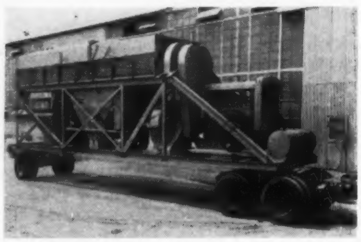
Butterfly Valves

THE EXPANSION OF AN EXTENSIVE line of tight-closing butterfly valves to include a full size range of 125-lb butterfly valves has been announced. Ideal as replacement valves, for pressure reducing and throttling functions, for street shutoff and pump discharge, these valves are lightweight and compact. **B-I-F Industries, CE-3, 345 Harris Ave., Providence 1, R. I.**

Central-Mix Stabilization

THE CONSTRUCTION INDUSTRY'S FIRST 1,000 ton-per-hour central-mix stabilization plant is now being manufactured. Completely portable, it also is the first to be equipped with double discharge hoppers.

The basic unit includes a twin shaft pug-mill type mixer and a five cu yd discharge hopper with a hydraulically operated clamshell gate. It also is built with an operator's platform running the full length of the unit, and includes a self-priming water pump and precision water meter to assure an accurate water flow to the spray bar.



Everything on the plant can be controlled from a central control panel on the operator's platform. The push-button panel is especially valuable on construction jobs in which critical ratios are needed. **The Boardman Co., CE-3, 1403 W. 11 St., Oklahoma City, Oklahoma.**

EQUIPMENT, MATERIALS and METHODS

(continued)

Core Drilling Machines

ACCORDING TO THE MANUFACTURER, the Models 40-C and 40-CL are the first choices of leading mining companies, contractors, and drilling companies who want a highly efficient drill designed and engineered to furnish dependable service under the most difficult field conditions.

The 40-C and the 40-CL are essentially the same, both having the same hoist, transmission, and choice of swivelheads and power units, as well as the same rated capacities. On the 40-C the power and drill units are arranged on a steel frame constructed so that the drill unit

Model 40-C

is directly connected to the power unit. The clutch is built into the drill unit. This type of mounting is known as the "in-line" type.

The 40-CL is constructed with the power unit mounted at a level lower than the drill unit. The power is transmitted from the power unit to the drill unit by a silent chain drive assembly. The clutch on the gasoline and diesel powered 40-CL machines is attached to the engine. The low center of gravity and the extra-long runners of a skid-mounted 40-CL make it an ideal machine when moving through rough, hilly terrain. **Sprague & Henwood, Inc., CE-3, P. O. Box 446, Scranton 2, Pa.**

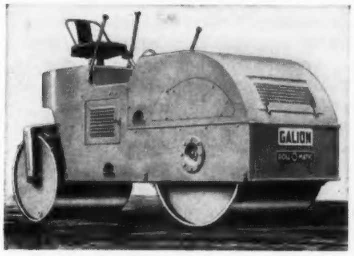
Rock N' Roll Concrete

BECAUSE A COLORLESS LIQUID, styrene, with a fragrant odor and a colorless gas, butadiene, with no odor have been teamed up with Portland cement and sand, contractors and do-it-yourselfers now have a revolutionary new concrete that bends, stretches and twists like a rock 'n' roll dancer. This magical, milky liquid, used in place of water, has presented a wide new horizon for the use of concrete where it was previously considered impossible. Unlike most innovations, material costs are low and labor is reduced.

Latex is the key to this miracle. Most of us think of it as a sticky substance milked from trees in Asia, Africa or South America, from which rubber is manufactured. In a limited sense this is true. However, scientists who have been bringing forth scores of latexes in the last two decades give the word a broader meaning. Their definition is "A suspension of submicroscopic particles in a liquid". Butadiene Styrene Latex is marketed under the trade name Super-Bondsit. **A. C. Horn Companies, Subsidiary of Sun Chemical Corp., CE-3, 750 Third Ave., New York 17, N. Y.**

Tandem Roller

COMPLETELY REDESIGNED AND EQUIPPED with Roll-O-Matic drive, the 3-5 ton tandem roller has all the features, appearance and design as used on the larger size tandem rollers, including the same type of sturdy frame and rugged guide roll yoke and hydraulic steering mechanism. Other features mentioned in the specifications include extra-large diam-



Roll-O-Matic Drive

eter ballastable rolls, dual operating controls, and spur gear final drive enclosed in oil-tight housing.

The Roll-O-Matic drive is a combination of torque converter, automatic fluid transmission, and tail shaft governor, which automatically multiplies power by means of oil instead of gears. The manufacturer states that more than twice the needed power is always available. When the governor lever is moved to the selected rolling speed, the engine power is applied and regulated automatically, shock loads are cushioned, no engine stalling or overloading. **The Galion Iron Works & Mfg. Co., CE-3, Galion, Ohio.**

EQUIPMENT MATERIALS and METHODS

(continued)

Combination Snowplow and Roll-Over Broom

A PIECE OF MAINTENANCE EQUIPMENT designed specifically for use by Highway and Street Departments in the ice and snow belts has been introduced. Called the Model S-40, it is used with four wheel drive trucks and incorporates a reversible combination snowplow and roll-over broom mounted ahead of the truck.

The snowplow and roll-over broom combination can be used for removal of snow and sleet, the plow handling snow and the sweeper taking care of water, slush and sleet. The operator can angle the plow to 32 deg in either direction,

Model S-40

and can change the blade angle during operation. For sweeping, the broom is hydraulically "rolled up-and-over" into working position in front of the plow, and can also be angled to 32 deg in either direction while operating at speeds from 8 to 15 miles per hour.

An Ice Roller-Crusher Ice Blade combination unit can be installed underneath the chassis of the truck for the removal of ice and packed snow. The Ice Roller-Crusher consists of free rolling, wobble discs that bear down on the ice to fracture the frozen surface; the Ice Blade is hydraulically operated and can be angled up to 20 deg in either direction. **Lull Engineering Co., CE-3, 3045 Highway 13, St. Paul, Minn.**

Dual Front Wheel Assembly

A NEW DUAL FRONT WHEEL assembly has been developed which will permit front axles to carry 18,000 lb or more and which will increase tire mileage better than 50%.

The dual front wheels give 100% more road contact, thus providing much increased safety for the driver and his load. The unit permits increased payload and additional "cube" capacity. **Truck Equipment Co., CE-3, 3963 Walnut St., Denver 5, Colorado.**

Literature Available

LIGHTWEIGHT PIPE—Data presented in Bulletin 59 includes standard specifications for Lockseam Spiralweld pipe in sizes from 4 in. to 30 in. in dia; illustrated information on one-piece Wedgelock couplings and other types of connections; and standard fittings for lightweight pipe and welding flanges for Naylor pipe. In addition, ordering information and applications in diversified industries are presented in concise form. **Naylor Pipe Co., CE-3, 1230 East 92nd St., Chicago 19, Ill.**

INSULATION MATERIAL—This 4-page folder contains background information on the unique new insulating and refractory material, Foamsil, which is 99% pure fused silica and has a practical operating range of —450 deg F to 2200 deg F. It is unaffected by practically all commonly used acids and also by thermal shock. A list outlining the physical characteristics of the material, along with recommendations for its possible uses, is contained in the booklet. Sizes and shapes available are also illustrated. **Pittsburgh Corning Corp., CE-3, One Gateway Center, Pittsburgh 22, Pa.**

FUEL BURNING SYSTEM—This new 8-page bulletin lists 11 sizes of oil, gas and combination gas and oil burners for firing boilers or other heat exchange equipment. Cutaway views in color visualize the principles of operation resulting in clean complete burning of even the dirtiest grades of fuel that provides exceptional combustion efficiency. Components can be completely packaged on a compact steel base or furnished separately for maximum flexibility. Typical burner arrangements are illustrated throughout the brochure. **Orr & Sembower, Inc., CE-3, Box 1138, Reading, Pa.**

CONSTRUCTION EQUIPMENT—An illustrated easily read pocket catalog, WCG-1P, lists 21 different items of concrete and asphalt placement equipment—available from one source—for use by contractors and local government maintenance of ways. Some of the equipment included in this brochure are: the power buggy, telescoping vibratory screeds, utility and standard buckets, collection hoppers, and tampers. **Watson-Cmetco, CE-3, 1316—67th St., Emeryville 8, Calif.**

GEARS—One of the world's largest manufacturers of custom gears has issued a profusely illustrated brochure on its products, plant and quality control facilities, as well as information on capacities, types, processes, materials, heat treatments and equipment. Some of the gears described in Bulletin 26 IG are: spur, helical, herringbone, worm, and bevel. **Illinois Gear & Machine Co., CE-3, 2108 N. Natchez Ave., Chicago 35, Ill.**

Films Available

"Photo-Reproduction"—Produced for showing to industrial, business and professional groups, particularly engineering management, this new 23-min color movie illustrates how organizations large and small can boost efficiency and cut drafting costs by putting photo-reproduction to work. From reclamation of illegible originals to cut-and-insert work on photographic enginering intermediates—which can trim a week's drafting job to eight hours—the motion picture accents potential savings. New short cuts, savings, and standards of legibility in industrial drafting operations are explained in detail. **Eastman Kodak Co., CE-3, Rochester 4, New York.**

"Taming a New Frontier"—A 16-mm, full-color, sound movie of the building of the gigantic Glen Canyon Dam in northern Arizona has just been released. Running 27 min, the film illustrates the birth of a new community and the monumental engineering effort that will affect living standards of millions of Americans when it begins producing 900,000 kw of electricity and providing water sufficient to irrigate tens of thousands of new acres. **International Harvester Co., CE-3, 180 N. Michigan Ave., Chicago 1, Ill.**

"Carrying the Load at Mackinac"—This new 16-mm sound film deals with construction work on the fabulous hundred million dollar Mackinac Bridge. Special emphasis is placed on the construction of Mackinac's thirty-four Prepakt concrete piers, since the superstructure phase has been well documented in other films. Events and problems leading up to this unprecedented project are also a part of the film story. **Intrusion-Prepakt Inc., CE-3, 568 Union Commerce Bldg., Cleveland, Ohio.**

"Introduction to Manual Heliarc Welding"—In this 8-min sound and color 16-mm motion picture, the beginner is given an orientation in Heliarc welding—how it works and what it can do. The movie shows the basic pieces of equipment and their relationship to each other, how to make a simple weld, and the excellent results that can be expected after practice. **Linde Co., Div. of Union Carbide Corp., CE-3, 420 Lexington Ave., New York 17, N. Y.**

"The Nature of Glass"—Some of the demonstrations and experiments found in this 37-min. color movie are: a glass nosed missile homing on a drone bomber; the intricate operation of a life-saving glass delay line for the early warning radar system; and a glass mold taking the fiery heat of molten steel. The unique fundamental structure of glass is shown, and major types of glasses are described and their characteristics pictured. **Association Films, Inc., CE-3, Broad at Elm, Ridgefield, N. J.**

From the MANUFACTURERS

RECEIVES AWARD: Mr. John MacLeod, President of Macco Corp. of Paramount, Calif., has received the '59 Golden Beaver Award for Management. At their fourth annual awards dinner, held in Los Angeles, Calif., the Beavers, an international fellowship of heavy construction and dam constructors named Mr. MacLeod recipient of the honor for his outstanding management record . . . **FACILITIES MODERNIZED:** Connors Steel Div., H. K. Porter Co., Inc., will start construction of new steel making facilities at its Connors Works in Birmingham, Ala. The expansion includes construction of a pouring building, adjacent to the furnace department, with a 25 ton crane and the installation of pouring car equipment . . . **NEW COMPANY:** A new company, Valco Inc., manufacturers of decorative and industrial, fiber glass reinforced paneling, has just opened offices and a research center at 7500 Fourth St., North, St. Petersburg, Fla. . . . **NAME CHANGE:** Termite Drills, Inc., Pasadena, Calif., pioneer manufacturer of multiple-carbide-cutter rotary masonry drills, Rapid Tap tapping fluid and Sta-put drill press clamps, has changed its name to the Relton Corp. Company address, phone numbers and agents and dealers will remain the same . . . The Four Wheel Drive Auto Co., Clintonville, Wis., has celebrated its 50th birthday by changing its name to FWD Corp. in order to avoid the misleading connotations of the old name . . . **NEW ACQUISITIONS:** Eugene Dietzgen Co., Chicago, Ill., announces the acquisition of Griscombe Products, Inc. of New York City, designers, manufacturers and holders of many patents on microfilming equipment . . . Johns-Manville Corp. becomes a major competitor in the expanding, nation-wide fiber glass industry with the acquisition of L.O.F. Glass Fibers Co. Transfer of all assets and the going business of the Toledo firm, second largest in the fiber glass industry in point of annual sales, to newly-organized Johns-Manville Fiber Glass Inc., a wholly-owned subsidiary of Johns-Manville Corp., has been accomplished, it was announced . . . **DISTRIBUTOR APPOINTED:** Aluminum Safety Products Inc., New York City, manufacturers of folding-type stairway, span and bridge scaffolds, stages and planks as well as ladders, announces the appointment of Safeway Steel Products Inc., Milwaukee, as exclusive distributor in the nation's steel scaffold industry . . . **GERMAN CHEMICAL PROCESSES OFFERED:** An agreement to act as sole North American agent for chemical processes developed and owned by the German engineering firm of Josef Meissner, Cologne, was announced by Girdler Construction Division of Chemetron Corp. Employed in plants throughout Europe, Asia and South America, Meissner processes have major applications in the explosives industry and in the manufacture of dyestuffs, plastics and other industrial products . . . **SIGN LICENSING AGREEMENT:** Permutit Co., Ltd., one of the world's largest and oldest water treatment equipment organizations, has become licensee for the manufacture and sale throughout most of the British Commonwealth of ion exchange membranes and equipment covered by the British patents of Ionics, Inc., of Cambridge, Mass. . . . **NEW FABRICATING PLANT:** Pittsburgh-Des Moines Steel Company's seventh fabricating plant, a new installation near Baltimore in the Curtis Bay area, is now in operation. The plant will be used for structural steel and heavy plate fabrication for bridges, storage tanks, wind tunnel components and a wide variety of related products . . . **GRANTED MANUFACTURING FRANCHISE:** Spunco Products, Inc., St. Louis, Mo., has been granted a franchise by Spun Concrete Corp. of America, Rochester, N. Y., to manufacture centrifugally spun concrete Lighting Standards, Transmission Poles, Sewer and Pressure Pipes and Columns. . . . **APPOINTMENTS:** McCulloch Corp., Los Angeles, leading manufacturer of power chain saws, outboard motors and other internal combustion engine products, has appointed Robert Orser as Advertising Manager for the Chain Saw Div. . . . Infilco Inc. of Tucson, Arizona, announces the appointment of Allen I. Barry as representative in all the New England States except Conn.

PROCEEDINGS AVAILABLE

January

1928. Vehicle Weight Phase of the Section 210 Study, by C. K. Glaze. (HW) This study examines truck weight and usage data as essential in highway design, administration, and finance. Weights were obtained at locations representative of the rural and urban federal-aid highway systems.

1929. Field Test of the Movement of Radioactive Cations, by Ben B. Ewing (SA) A synthesized radioactive waste injected into a confined permeable underground formation was traced by radioassay of samples from monitoring walls. Results were correlated with field-scale hydraulic flow tests and a laboratory investigation of ion-exchange properties of earth material taken from the same formation.

1930. Treatment of Liquid Radioactive Wastes, by Conrad P. Straub. (SA) A review is presented of the methods used in handling, treating, and disposing of liquid radioactive wastes in the United Kingdom and Europe.

1931. Water Pollution in our Changing Environment, by C. H. Atkins. (SA) The increase in water usage has brought many challenges in the control of water pollution. All concerned must do their utmost to conserve and protect our water resources.

1932. Radioactive Pollutants, Progress Report of Task Force VI of the Committee on Atmospheric Pollution of the Sanitary Engineering Division. (SA) This report recognizes the extent of the airborne pollutant hazards being created by the expanded use of radioactive tracers and energy. Maximum contrations, as well as survey methods, instrumentation, and cleaning devices are examined.

February

Journals: Hydraulics, Soil Mechanics and Foundations, Structural, Power, Irrigation and Drainage, Construction.

1933. Unsteady Flow in Conduits with Simple Surge Tanks, by E. H. Taylor, Arnold Reisman and Jack W. Ward. (HY) This paper presents a general solution to the simple tank problem in terms of a single dimensionless damping parameter for the case of instantaneous and complete load rejection.

1934. Evaporation of Lake Ontario, by Ira A. Hunt. (HY) Evidence is sited that precipitation over the Great Lakes is less than precipitation on adjacent land areas. Evaporation computed by the water budget method is reduced in the same amount as the precipitation.

1935. Problems Concerning Use of Low Head Radial Gates, by Thomas J. Rhone. (HY) Three hydraulic features of low head radial gates are examined. These are a general discharge equation, the effect of gate seat location on discharge capacity and pressure distribution along the spillway surface, and side and bottom seals.

1936. Underseepage Control at Fort Randall Dam, by S. T. Thorfinnson. (SM) A relief well system installed to control underseepage beneath Fort Randall, which is located on the Missouri River in southaestern South Dakota, is studied.

1937. A Review of the Engineering Characteristics of Peat, by Ivan C. MacFarlane. (SM) A resume of information concerned with physical and mechanical properties of peat is presented.

1938. Design Standards for Timber Structures, by Robert E. Eby. (ST) This paper reviews the content and development of design standards as well as supplemental data pertraining to the use of wood as an engineering material.

1939. Statistical Approach to Working Stresses for Lumber, by J. D. Snodgrass. (ST) Working stresses are obtained by applying appropriate reductions to values selected at a low probability from strength distributions.

1940. Analysis of a Two Way Truss System, by John A. Sbarounis and Michael P. Gaus. (ST) Two methods of analysis for a two way system of trusses rigidly connected at points of intersection and rigidly or elastically supported, is presented.

1941. Overload Factors Can Cause Ultra-Conservative Design, by Richard N. Bergstrom. (ST) The use of overload factors in establishing design stress for reinforced concrete, prestressed concrete structures and steel transmission towers is reviewed.

1942. Aseismic Design of Structures, by Rigidity Criterion, by Edward Y. W. Tsui. (ST) A set of curves showing the proposed design seismic coefficients as function of the rigidity of structures is presented. These coefficients are based on the modified response spectra obtained by means of analog computers.

1943. Self-Checking General Analysis of Rigid Frames with Sway, by F. C. Keller. (ST) This paper describes a semigraphical self checking process, by which plane rigid frames subject to sway are solved for moments, shears and axial forces simultaneously.

1944. Correlation of Predicted and Observed Suspension Bridge Behavior, by George S. Vincent. (ST) The validity of model tests and analysis as an indication of the behavior to be expected of a suspension bridge in the wind is considered.

1945. Boundary-Shear Stress in Unsteady Turbulent Pipe Flow, by M. R. Carstens and John E. Roller. (HY) An analytical solution for the boundary-shear stress of unsteady turbulent pipe

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flow is presented based upon the hypothesis of similarity of velocity profiles of steady and unsteady flow.

1946. Hydraulics of Circulating Systems, by Clifton W. Bolieau. (PO) This paper reviews the factors entering into the design of condenser circulating water systems, with particular reference to those in the TVA system.

1947. Passage of Young Fish Through Turbines, by J. F. Muir. (PO) The hypothesis that mortality of young fish passing through turbines is caused mainly by exposure to cavitation is developed here.

1948. 305,000 KW Extension to the Fisk Steam Electrical Station, by Merle H. Goedjen, Richard M. Collins, and John P. Roche. (PO) This paper describes the design of a large single unit extension to an historic steam electric station. A study of its unusual features is included.

1949. Site Studies for a Steam Power Plant, by R. D. Chellis and E. Ireland. (PO) This paper emphasizes critical investigations, presents detailed estimates for each possible scheme and justifies the final choice of location.

1950. Discussion of Proceedings Paper 1345, 1449, 1451, 1528, 1834. (HY) Corrado Ruggiero corrections in 1345. Walter L. Moore and Carl W. Morgan closure to 1449. J. L. H. Paulhus and J. F. Miller closure to 1451. Hunter Rouse, T. T. Siao and S. Nagaratnam closure to 1528. K. R. Wright on 1834.

1951. Discussion of Proceedings Paper 1439, 1537, 1550, 1654, 1655, 1727, 1728, 1729, 1730, 1731, 1826. (SM) K. S. Lane no closure notice to 1439. E. B. Penrod, W. W. Walton and D. V. Terrell closure to 1537. Armand Mayer closure to 1550. D. Hugh Trollope on 1654 Jose A. Jimenez Salas, D. Hugh Trollope on 1655. Harry R. Cedergren on 1727. M. L. Dickinson, J. R. Kiely on 1728. Icarahy da Silveira on 1729. A. A. Eremin, N. N. Ambraseys on 1730. Bruce E. Clark, Herman L. Moor, Robert E. White on 1731. Thomas B. Kennedy corrections to 1731. Edward S. Barber on 1826.

1952. Discussion of Proceedings Paper 1316, 1354, 1561, 1562, 1567, 1637, 1638, 1694, 1709, 1838, 1839, 1840, 1854, 1867, 1878, 1944. (ST) E. J. Ruble on 1316. Raymond Archibald, on 1316. Alfred M. Freudenthal closure to 1316. Robert E. McClellan no closure notice to 1354. George Winter closure to 1561. Henry Malter closure to 1562. Harry Posner closure to 1567. T. J. McClellan closure to 1637. John E. Goldberg closure to 1638. J. G. MacGregor and C. P. Siess, Phil M. Ferguson on 1694. John S. McNown and Dorris Hankins on 1709. E. George Stern, Richard G. Kimbell, Jr. on 1838. E. George Stern on 1839. Donald G. Coleman corrections to 1840. Glen V. Berg on 1854. E. I. Fiesenheiser on 1867. George C. Ernst on 1878. F. B Farquharson on 1944

1953. Discussion of Proceedings Paper 1344, 1457, 1529, 1554, 1555, 1598, 1670, 1672, 1675, 1683, 1687, 1733, 1734, 1740, 1748. (PO) Ewald Schmitz closure to 1344. F. W. Patterson, R. L. Clinch and I. W. McCaig closure to 1457 J. Barry Cooke closure to 1529. Claudio Marcello closure to 1554. Tatsuo Mizukoshi closure to 1555. Andrew Eberhardt closure to 1598. F. L. Lawton on 1670. F. L. Lawton on 1672. C. F. Colebrook, John B. Milne, J. Guthrie Brown, F. L. Lawton on 1675. F. L. Lawton on 1683. W. A. Brown, John V. Spielman, P. L. Aitken, F. L. Lawton, Claude A. Fetzer and Elton G. Knight, Harris C. Porter on 1687. Joseph C. Dodd on 1733. George K. Leonard on 1734. F. L. Lawton on 1740. Judson P. Elston on 1748.

1954. Engineering Education and the Construction Industry: The Industry and the Colleges, by D. W. Winkelman and C. R. Maar. (CO) This paper examines the influence of the engineering college on the engineer, stressing the importance of the humanities, and a practical working knowledge of the tools at hand.

1955. Engineering Education and the Construction Industry: Graduates for Work in Construction, by David A. Day. (CO) A modernized under-graduate curriculum benefiting the construction industry, should include report writing, public speaking, basic sciences, engineering sciences, analysis, economics and management, and some humanities.

1956. Engineering Education and the Construction Industry: Modern Trends in Construction Engineering Education, by Robert L. Schiffman. (CO) The current trends in engineering education towards a first degree in the engineering sciences and professional training similar to Law and Medicine are examined.

1957. Engineering Education and the Construction Industry: The Engineering Profession in Construction, by Roger Corbetta. (CO) Preparation for the construction industry should stress the coordinating by one person of all facets of a construction job from start to finish.

1958. Engineering Education and the Construction Industry: Campus to Construction, by H. A. Letoile. (CO) The construction industry has found a need to supplement the education of its civil engineers. One organization has established a four year program that trains college graduates to be construction executives.

1959. Engineering Education and the Construction Industry: What the Industry Should Have From the Colleges, by C. H. Oglesby and John W. Fondahl. (CO) The civil engineering profession has much to gain by strengthening its ties with construction and it should be done by construction sponsored research in the colleges, as well as bolstering the college curriculum.

INSTRUCTIONS

1. Every ASCE member can be registered in two of the Technical Divisions and receive automatically all papers sponsored by those Divisions. **Such registration will be effective 30 days after the receipt of the registration form.**

2. In addition to those papers sponsored by the Divisions in which he is registered, a member is entitled to 100 different papers during a fiscal year beginning October 1.

3. Members' accounts will be charged 25¢ each for additional duplicate copies of a paper and for papers in excess of his free allotment.

4. Papers should be ordered by serial number. The member should keep a record of papers ordered to avoid unwanted duplication.

5. Non-members of the Society may order copies of Proceedings papers by letter with remittance of 50¢ per copy; members of Student Chapters, 25¢ per copy.

Standing orders for all Papers in any calendar year may be entered at the following annual rates: Members of ASCE, $15.00; members of Student Chapters, $15.00; non-members, $40.00; libraries, $25.00.

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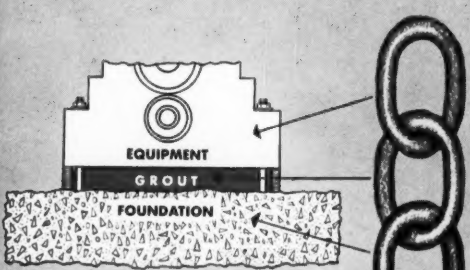

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